POPULAR SCIENCE

MECHANICS AND HANDICRAFT

July, 1950 • 25¢

Patching With a Brush – p.218

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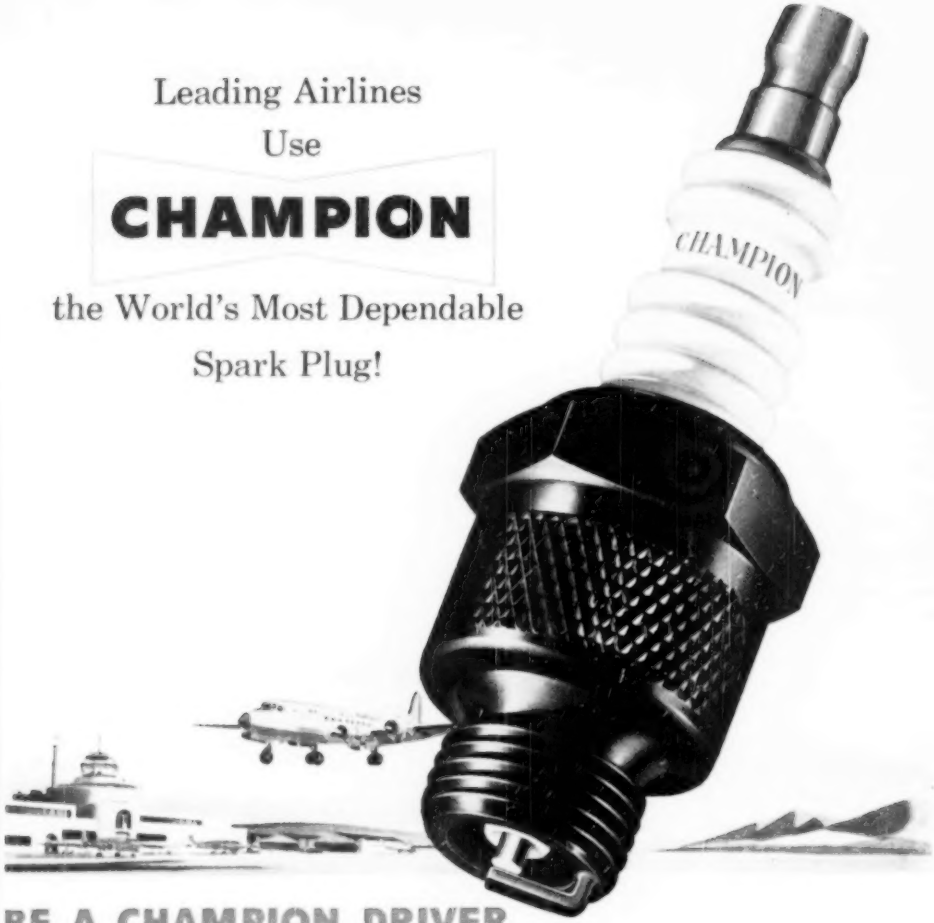

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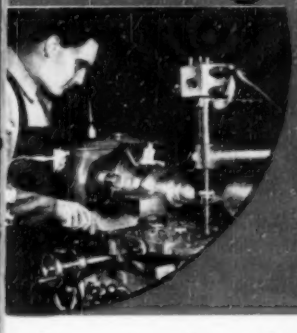

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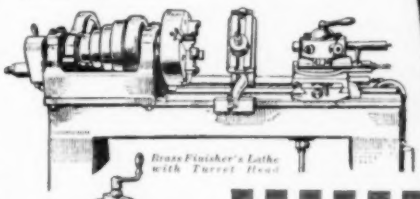
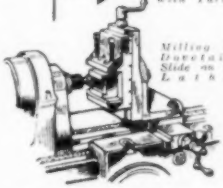
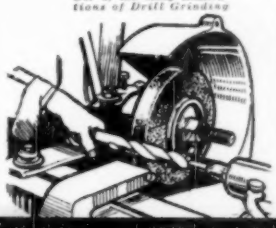


Brass Finisher's Lathe with Turret Head



Milling a Dovetail Slide on a Lathe

One of the many illustrations of Drill Grinding



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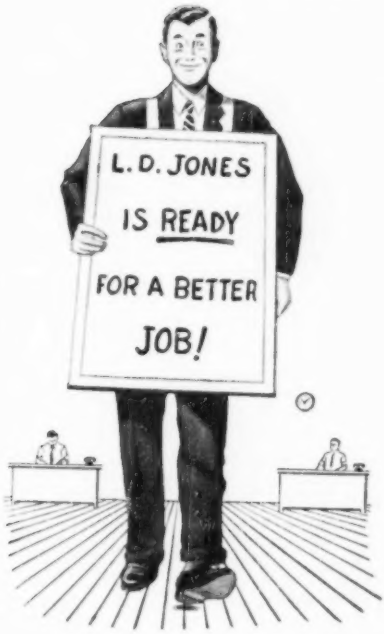
HOW TO IMPRESS THE BOSS



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Build a Family Theater in Your Living Room

If the radio, phonograph, and TV set in your home have been bought piecemeal, chances are your living room has a hodgepodge of cabinets connected by a rat's nest of wires. At least that's the way it was with Dick Prentice, until his wife began to holler. What the outcome was, and what they cooked up between them, is shown on eight unusual pages in our August issue. Since you don't have to be an amateur Chippendale to do it yourself, you won't want to miss this story.

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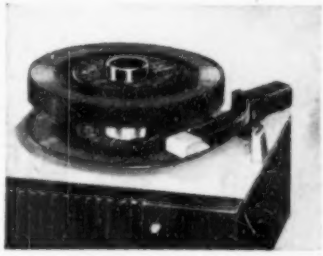

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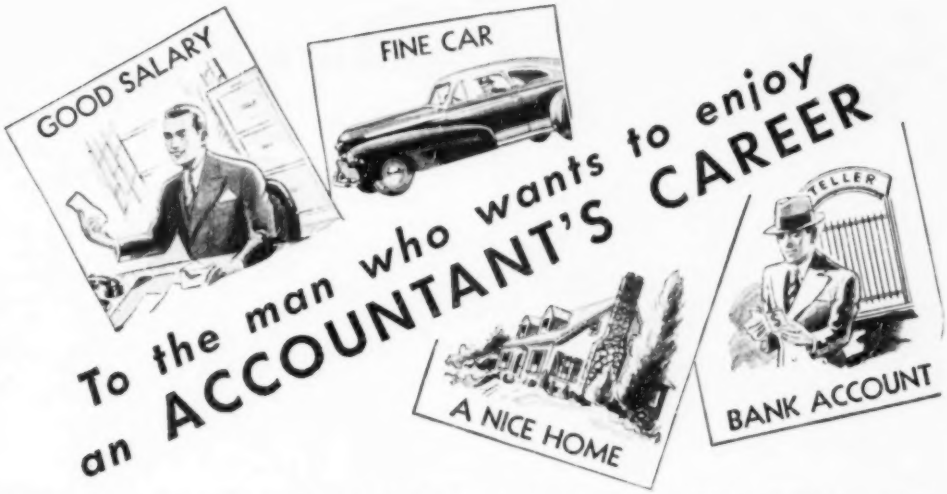
CPL. McGOVERN CLIMBING ABOARD AN ARMY LOCOMOTIVE AT FT. EUSTIS, VA.



To the man who wants to enjoy an ACCOUNTANT'S CAREER

IF you're that man, here's something that will interest you.

Not a magic formula—not a get-rich-quick scheme—but something more substantial, more practical.

Of course, you need something more than just the desire to be an accountant. You've got to pay the price—be willing to study earnestly, thoroughly.

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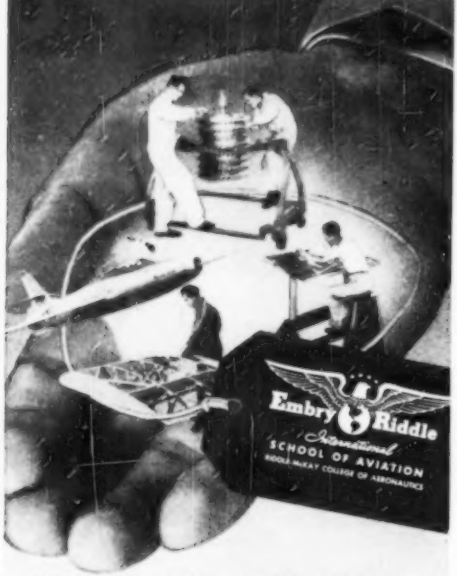

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Letters

What's That Smell?

Sir:

I wonder if you could help settle an argument that has arisen among a group of us here at the University of Tennessee. We have been trying to figure out just what makes a new car smell new! I know it sounds ridiculous, but we still haven't found a satisfactory answer.

We thought perhaps it was some chemical in the lacquer, or a composite of several; but my chemist friends know these chemicals and haven't been able to identify that

distinctive odor. Someone suggested that the upholstery was chemically treated, and one man attributed the smell to a sound-deadening paste sprayed into the material under the roof of the car.

Can you give us an expert answer?

WILLIAM J. STARR

Knoxville, Tenn.

There are only two major causes of new-car smell: rubber cement, used in installing cloth and fabric trim, and the rubberized metal-sealing compound used to embed windshield and back-window assemblies in their openings and to waterproof all metal-to-metal joints. There are now on the market at least two chemical perfumes, or "reodorants," for spraying in used cars to make them smell like new.

Why Rockets Come Back

Sir:

An interesting question is raised by the picture in your April issue [p. 170] of a switch that took a ride in a Wac Corporal rocket that soared beyond the earth's atmos-

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Latest Winner List! Free course winners in previous contest—from list just released: Mrs. E. Eaton, Rt. 5, Coshocton, Ohio; Mrs. L. Webster, 259 Beechwood, Princess Anne, Md.; G. Ratzmer, 1468 Highland, Lakewood, Ohio; C. Faiello, Box 188, Magnolia, Ohio; U. Bahan, 5249A Devonshire, St. Louis, Mo.

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Please enter my attached drawing in your September drawing contest. (PLEASE PRINT)

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The ROSICRUCIANS

San Jose (AMORC) California

phere to a record height of 250 miles above White Sands, N. M.

According to accepted theory, this earth has a peripheral speed of 1,000 miles an hour due to its easterly rotation, plus an orbital speed of some 66,000 m.p.h. around the sun, and is supposed to go forward with the sun toward the constellation Hercules at an estimated speed of 45,000 m.p.h.

Heretofore, when the question has been asked as to why an object leaving the earth does not show some movement to the west, the stock answer has been that the earth carries its atmosphere with it. But when a rocket reaches the rare atmosphere at 250 miles above the earth, there should be sufficient lag to cause a westward movement such as that observed in pictures of a spiral nebula.

Is not the lagless climb and fall of this rocket the first proof that, actually, the earth has little if any movement?

CHARLES W. WARD

Bradenton, Fla.

Answer: No.

A rocket standing on the ground prior to launching is at rest with respect to the earth and is, therefore, partaking of the earth's motion—that is, traveling east at a speed of 750 m.p.h., the earth's rotational surface velocity at the latitude of White Sands. The mere fact that the rocket is propelled vertically to a high altitude does not destroy this easterly velocity. Therefore, the rocket remains more or less straight above the take-off point in both its upward and downward flight. And it, or any surviving fragment, falls near the launching site.

Secrecy vs. Security

Sir:

Your articles in recent months on military tactics and equipment have been highly interesting. However, I believe they are too detailed for public presentation. I believe that a specialist in military equipment may be able to deduce more from the given information than is safe. It is conceivable that a potential enemy of the United States might be able to develop preventive measures from deductions based on this type of article. Since the world situation is at this moment so very tense, I believe that it would be better to discontinue articles of

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3. BRIGHT FUTURE

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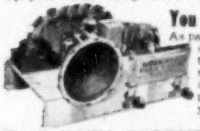

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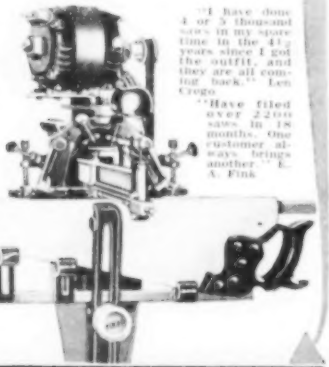

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this sort, even if it meant keeping the public in ignorance of the technological advancements being made.

LOTHAR GOTTLIEB

New York, N.Y.

PS concedes that it is necessary, in the present state of the world, to keep certain details of U.S. military equipment secret. What those are we leave to the authorized judges, by adhering strictly to the security regulations of the armed forces and the Atomic Energy Commission.

But our country's future security, we believe, depends not merely on keeping old ideas locked up. Just as important is keeping ahead of rivals in generating new ones for tomorrow—by the customary process of rubbing today's ideas together. To stop that, by "keeping the public in ignorance," seems to us the greater risk to our security—and our democracy.

Model A(2)

Sir:

I want to second the motion of reader Albert A. Johnson [PS, May, p. 16] that the Ford people resume making their famed Model A to meet the need for a low-priced really practical car.

But I don't agree that they should "not change a single nut or bolt." There are three necessary changes that should be made to fit today's conditions: (1) hydraulic brakes, (2) gear shift on steering column, (3) modernized body.

L. G. POLLOCK

Wood, S. D.

Proposed: A PS Quiz

Sir:

Many of your articles are just as educational as any high school text book. So why not run a short test or series of questions over each of your more important articles? A person could obtain a pretty good education just from reading your magazine if you

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did something like that to encourage him to study it carefully.

HUBERT MCCALLUM

Houston, Tex.

How many other readers would like an occasional PS Quiz?

Puzzle Solution

Sir:

I'm puzzled by one thing in that picture of the self-winding Swiss car clock shown on page 130 of your May issue. The clock is mounted on the steering wheel of what appears to be a 1949 or '50 Oldsmobile. But the figures on the speedometer, visible through the wheel, run up to 180 miles an hour!

RICHARD BOYLE

Athens, O.

Looks impossible to me; since I own the same type of Oldsmobile, with speedometer dial reading only up to 110.

NORMAN FOURNER

Lewiston, Me.

Wha' hoppen?

DONALD HARVEY

Goshen, N.Y.

To the dozens of sharp-eyed PS readers who spotted this detail:

The photo, like the clock, was made in Switzerland—where distances are measured, not in miles, but in kilometers. At .6214 miles to the kilometer, 180 kilometers equals about 112 miles.

Automatic Drives

Sir:

Just a line to let you know that your April story on automatic transmissions—and a good one it is!—has attracted attention here.

Knowing your sincere desire for accuracy, though, I want to offer a small correction in the Box Score on page 105:

Ultramatic Drive is standard equipment on Packard custom models and available at extra cost ($185, including Federal excise taxes) on all other cars in our 1950 line.

SYDNEY J. KEITH

Packard Motor Car Co.,
Detroit, Mich.

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Use these patent laws for your protection. Investigate whether your invention can be patented. If you have what you believe to be an invention, we suggest that you have this firm make a search for you.

Send for a copy of our Patent Booklet entitled "How To Protect Your Invention," containing information about patent protection and patent procedure. Along with this we will also send you an "Invention Record" form, for your use in writing down and sketching details of your invention. We will mail them promptly. No obligation. They are yours for the asking.

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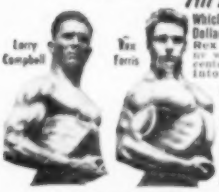

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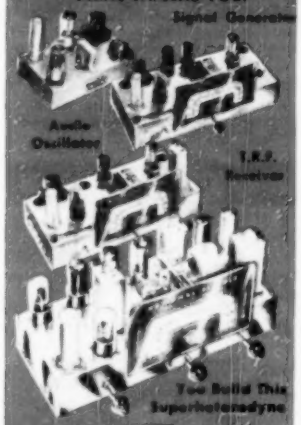

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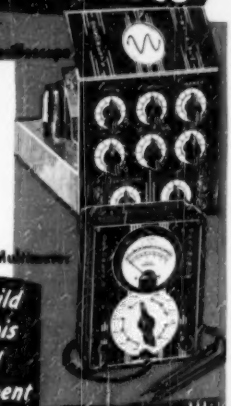

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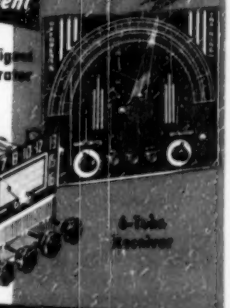

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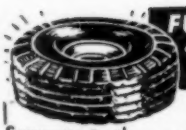

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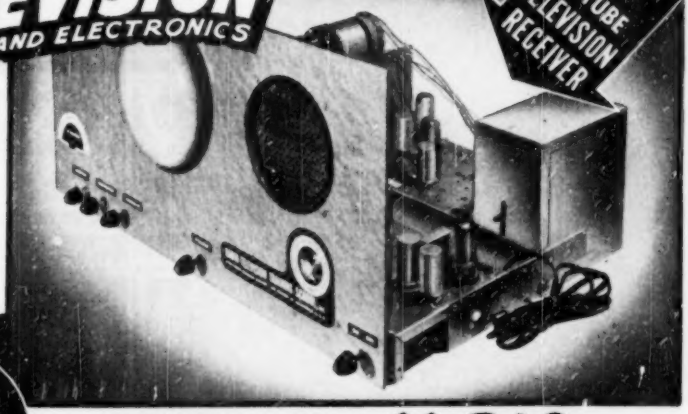

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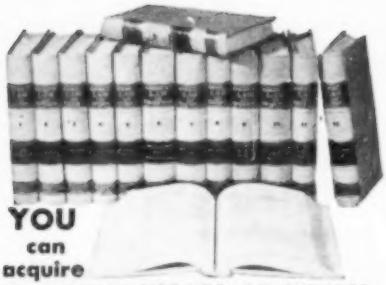

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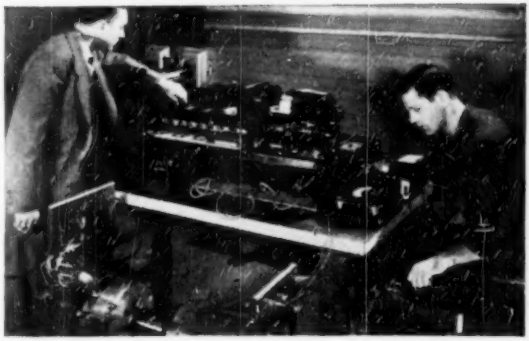

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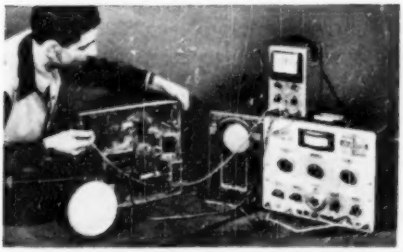

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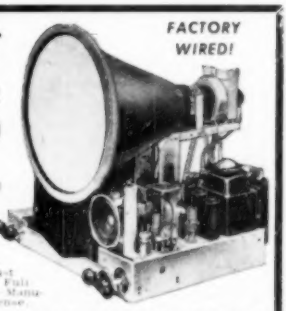

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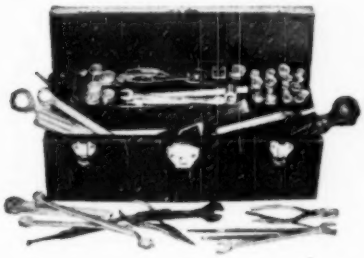

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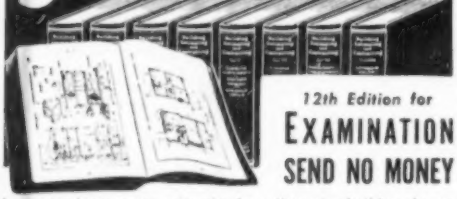

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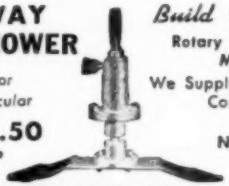

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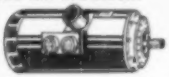

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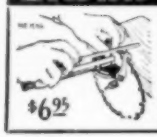

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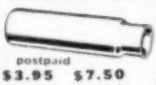

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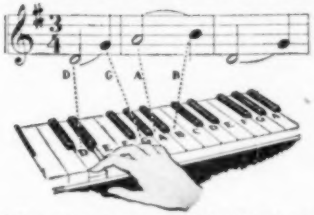

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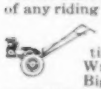

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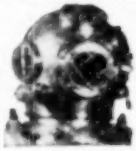

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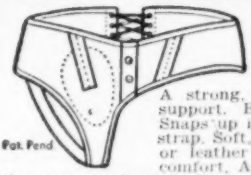

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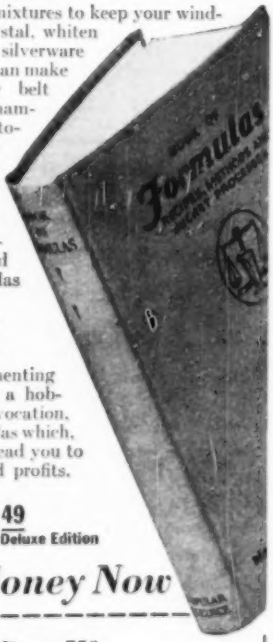

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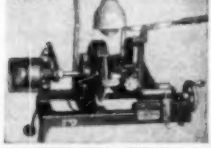

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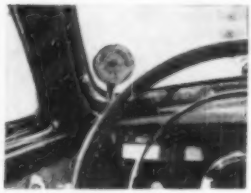

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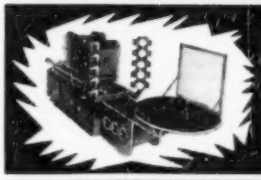

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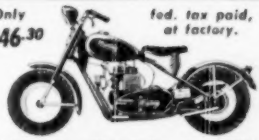

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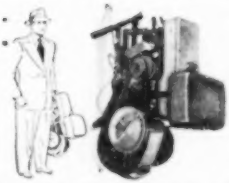

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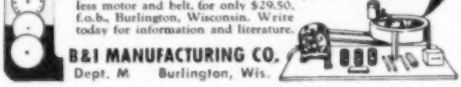

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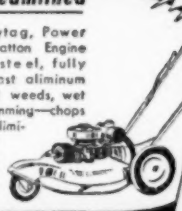

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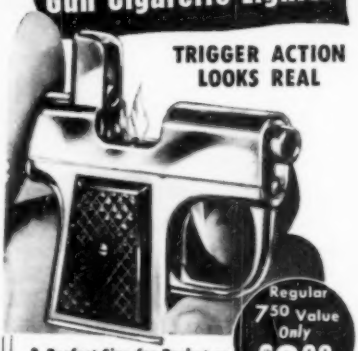

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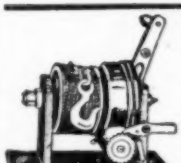

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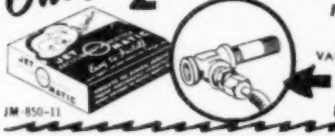

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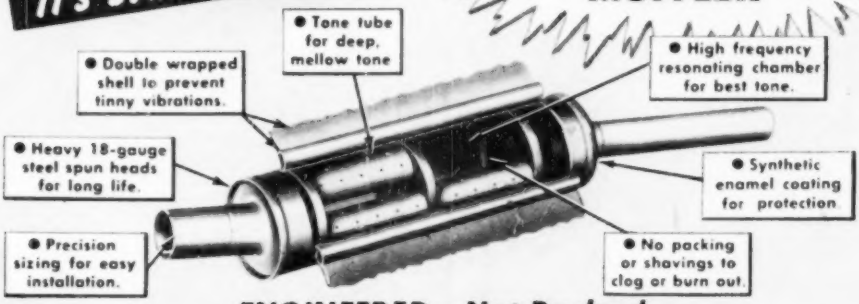

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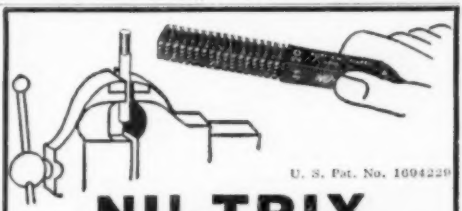

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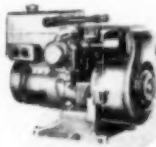

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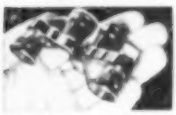

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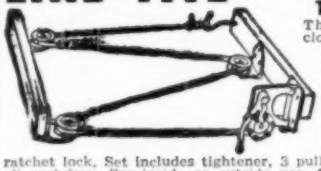

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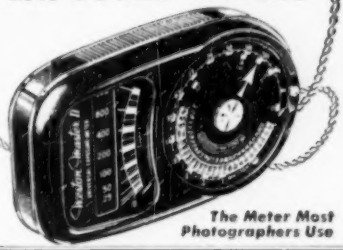

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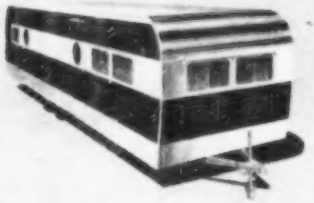

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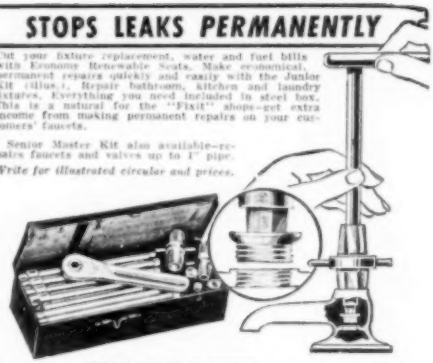

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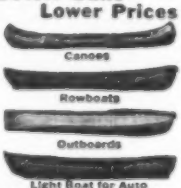

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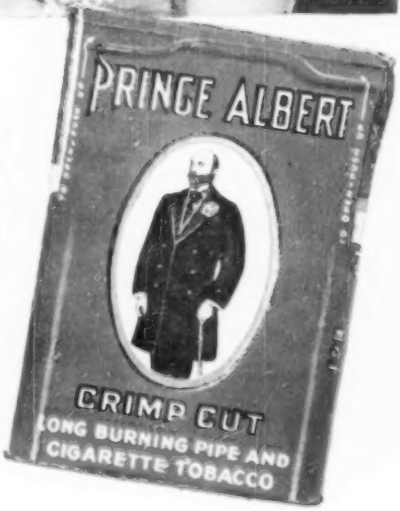
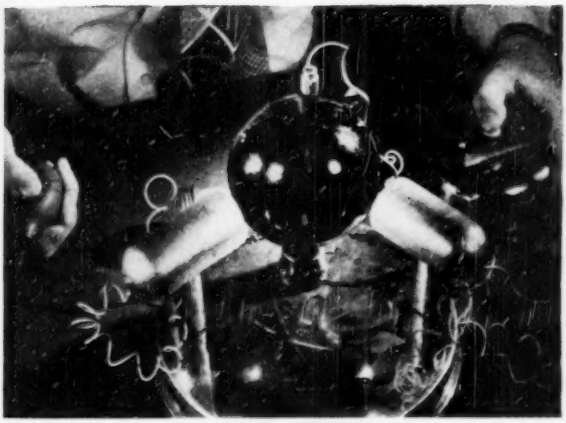


THE NATIONAL JOY SMOKE!

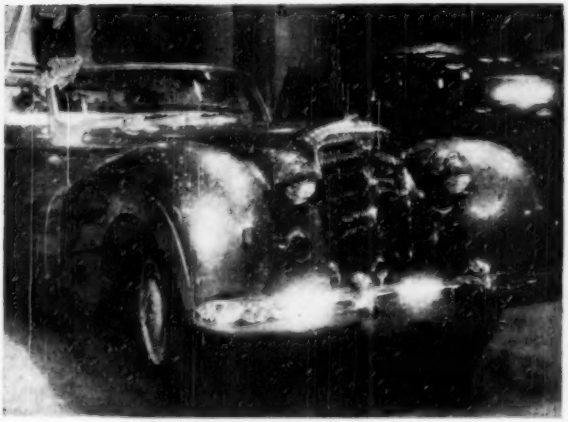
Popular Science *Highlights* this Month

HOME LAUNDRY FOR YOUR CAR: Low-priced spray, fastened inside garage door, gives automobile a wash in six minutes. **Page 138**



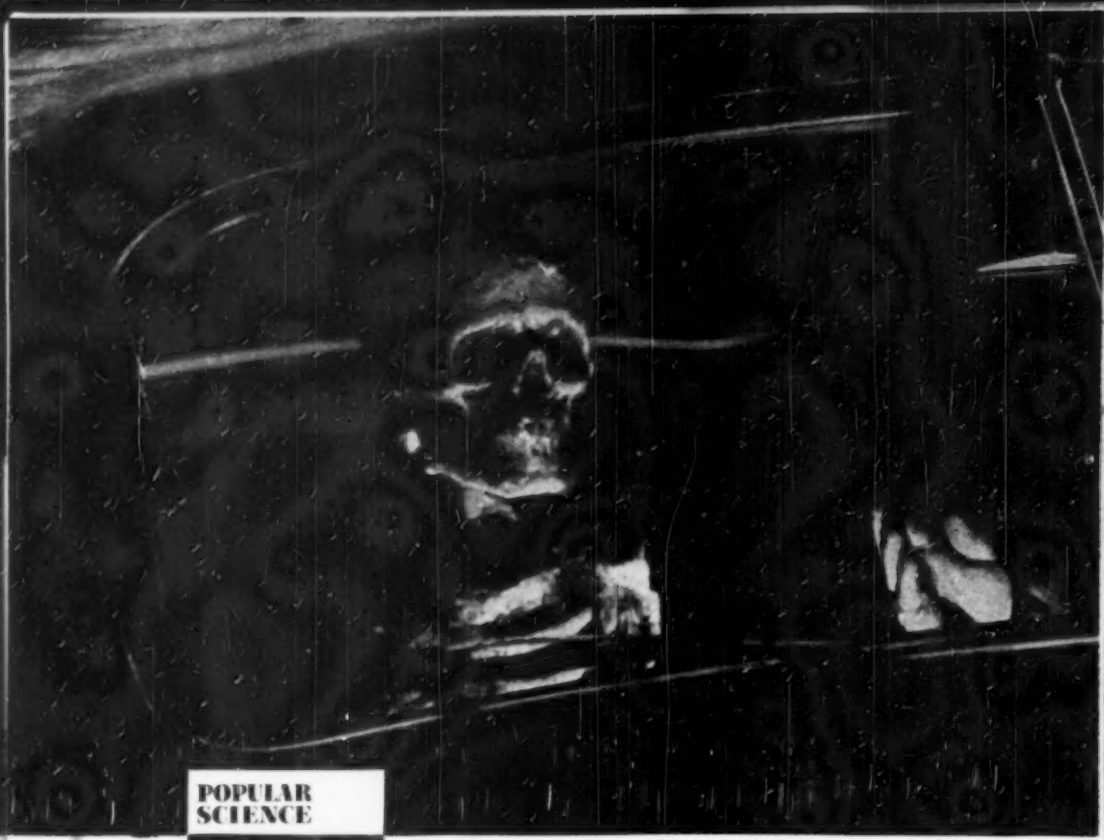
TOYING WITH ATOMS: Geiger counters and cloud chambers will keep Junior as busy as the biggest nuclear scientist. **Page 183**

READY! AIM! CLICK! Gunstock camera brings distant subjects up close as you shoot through the telephoto lens. **Page 211**



BRITISH CARS: Six pages of photos show—close up—what's different about new models you'll see on U. S. roads this summer. **Page 126**

BUILD A PLASTIC PARTITION: Handsome new blocks fit right into a framework you can make with a hammer and saw. **Page 180**



POPULAR SCIENCE

Cover by Reynold Brown

Death has an option on the next seat every time you drive.

Making the

By George H. Waltz, Jr.

PS photos by Hubert Luckett

THE most dangerous seat in the world is not the electric chair at Sing Sing, nor the one in the gas chamber at San Quentin—it is the right front seat in any car, *including your own!*

Some 300 holiday-happy men, women, and children, it has been estimated, will meet horrible deaths in automobile smash-ups during the four-day July 4th celebration this year. Many more will be cut, shocked, and painfully maimed. And, according to statistics, approximately 204 of those 300 dead will have been persons who were sitting in the seat next to the driver!

Death never takes a holiday. He rides in every car, every day, with his bony finger on the right front seat—the death seat—the seat occupied by 68 out of every 100 victims in fatal car crashes, the seat most often occupied by mothers, wives, sweethearts, and children. At that, the figure may be low; not every car involved in a fatal accident has someone riding in the death seat.

Sixty-eight percent is impressive enough however to make safety engineers concentrate on the problem of the right front seat when they study ways of designing safer car interiors. And they're making real progress. At the Cornell Aeronautical Labo-

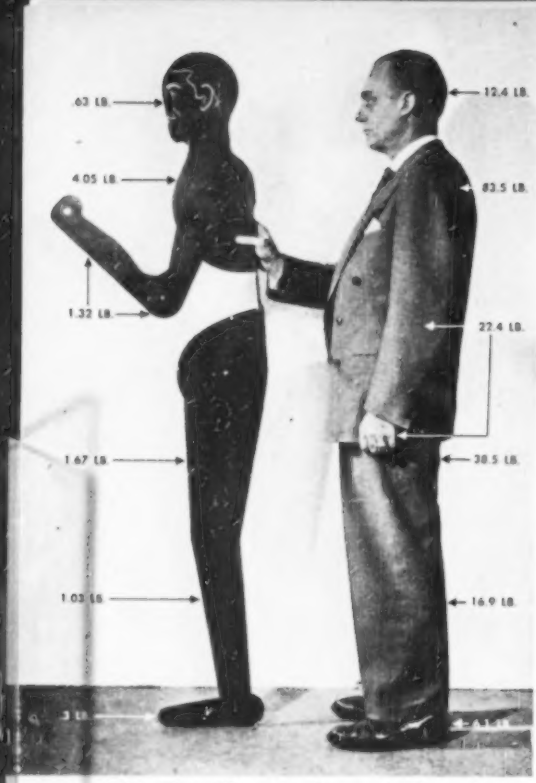
And it's where your wife or kids usually sit.

Death Seat Safer

ratories in Buffalo, N.Y., for example, the Thin Man is teaching scientists how to cheat Death by building safety right in the car.

The Thin Man is a jointed full-size sheet-aluminum figure of a man. He rides the death seat in a speeding "car" that never travels more than a few feet. The Thin Man is the brainchild of Edward R. Dye, chief of the laboratory's Development Division. Although he tips the scales at only 9 lb.—just 1/20 the weight of the 180-lb. man he represents—the various parts of his body are so weighted that they are not only in proportion to those of the human body, but have the same relative centers of gravity. The Thin Man even has a flexible backbone in the form of a carefully calculated dural spine, as well as joints that can be tensed to provide relative muscular restraint and instinctive pre-collision bracing.

The Thin Man's car or cockpit is a horizontal, two-dimensional affair that rides on two rails mounted on the laboratory floor. In use, with the Thin Man in place on the seat, it is snapped backward by long elastic cords (airplane shock cords) to simulate the rapid slowing down, or deceleration, experienced during a crash. This jerking of the car backward provides the same relative acceleration of the Thin Man with respect to the car as if a fast-moving car was stopped suddenly. For test purposes, it's easier to do



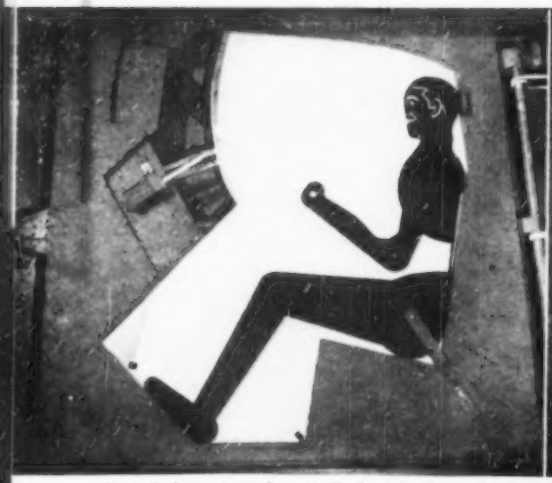
This Thin Man, standing with the author to show comparative weights of body parts, is helping Cornell Aeronautical Laboratory engineers learn how to make the death seat safer.

and takes less space on the laboratory floor.

During each test crash, which lasts but a fraction of a second, the paths of the Thin Man's head and the major joints of his body are automatically traced on a paper background. At the same time, an ingenious electric sparking device, wired to the various pencil leads that mark the paths, burns pin-point holes in the paper at uniform time intervals. These holes allow the velocities and accelerations of the various parts of the Thin Man's body to be calculated accurately. To evaluate each "crash," an energy-absorbing gauge measures the Thin Man's impact force. At the end of each test, the Thin Man provides experimenters with a vivid picture of just what would happen to the body and head of a 180-pound person under similar crash conditions.

Because cracked skulls are one of the major causes of crash casualties, most of the experimental work so far has been directed toward finding out just what happens to a car rider's head when a car smashes up.

According to the Thin Man, the body of a relaxed, unrestrained passenger in even a fairly minor crash moves upward and forward with considerable force. At a deceleration of 2 G—about the tops you can get if you tramp down as hard as you can on perfect brakes, with new tires, and on a high-friction road surface—the Thin Man is thrown forward violently. His head strikes



Seat belts, properly installed and adjusted, are one answer to the problem of greater car safety. Here, seat belt in place, the Thin Man sits in his car before the test.

In 2G crash, the Thin Man's head, thanks to seat belt, strikes dashboard with a scale impact of 400 in.-lb.—a good bump, but probably not enough to crack skull or cause death.

the upper front corner of his cab with a force equivalent to 1,000 inch-pounds for a 180-pound man. Few skulls can withstand an impact, against something hard, of more than 600 inch-pounds!

At a deceleration of 4G or more, not even a strong man can brace himself sufficiently to ease the impact materially. As researcher Dye puts it. "Trying to tense yourself against a 4G crash would be like trying to do push-ups with three other fellows sitting on your back."

Tests with the Thin Man show that at a deceleration of 5G, which is the minimum in a bad car smash-up, the head of a 180-lb. man, not tensed for the crash, will hit in the vicinity of the top of the windshield frame with a skull-splitting impact of about 3,800 inch-pounds!

One obvious answer to the problem is the use of some sort of body-restraining device, such as a seat belt. However, experiments with the Thin Man have shown that not just any belt will do. It must be properly designed and properly adjusted. Tests indicate that it should be mounted at an angle of 60° from the horizontal and be adjusted to allow 3 inches of hip movement. When the Thin Man made a 2G crash wearing such a safety belt, his head hit with an impact equivalent to only 400 inch-pounds for a 180-pound man—compared to 1,000 inch-pounds without the strap.

How to Make Cars Safer

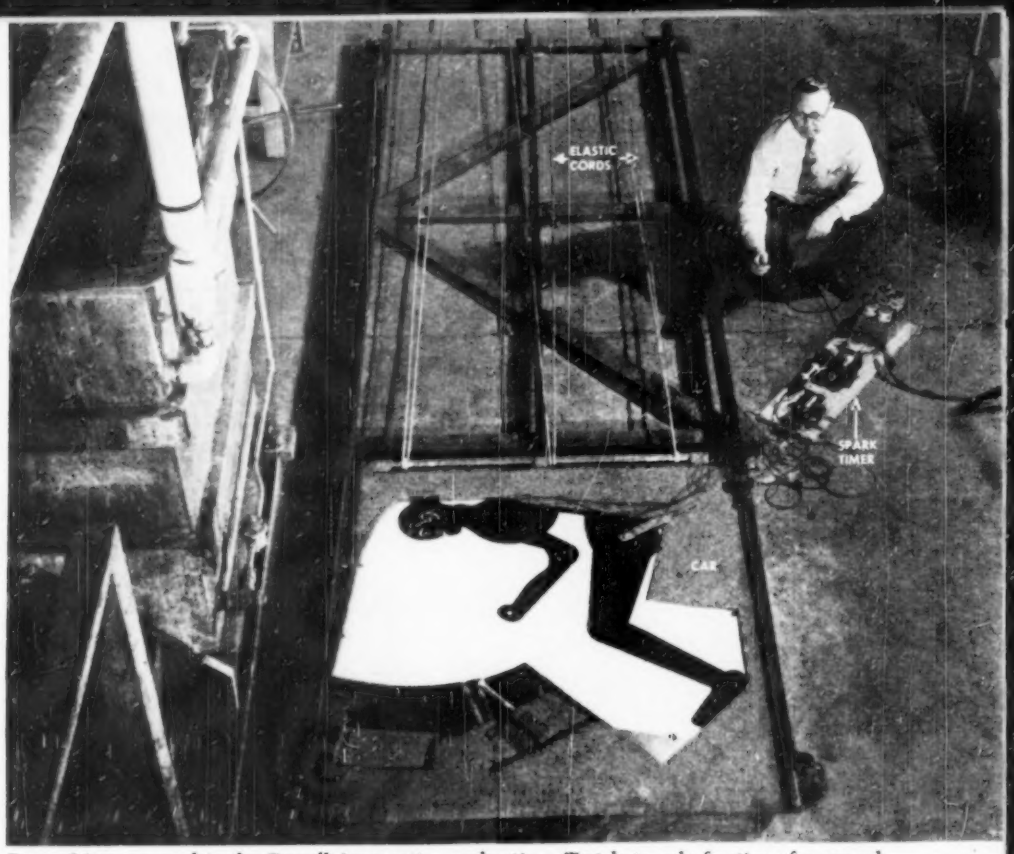
Because of his experiments with his Thin Man, Edward Dye has many suggestions about what could be done to increase automobile safety. First of all, the public—and that means you and me—must encourage automotive designers and engineers to build safety into their cars. We can do this by *not* demanding useless frills and living-room comforts on our Sunday-afternoon drives. The more complicated a car interior becomes—the more gadgets it boasts—the more dangerous it becomes. Such things as radio knobs, ornamental door handles, defrosting fans, spotlight handles, and trick sun shades may be handy accessories, but they can become lethal weapons in a smash-up.

All possible head-impact surfaces should be smooth. Dashboards should be covered with a crushable padding material at least 1 inch thick. Padding should not be an energy-storing material like rubber, but an energy-absorbing material like polystyrene foam, balsa wood, or any similar cellular

Without seat belt in 2G crash—deceleration obtained in quickest brake stop you can make under perfect conditions—Thin Man's head hits hard enough to bash in skull of a 180-lb. man.

In 4G crash, without seat belt, Thin Man lands in almost same place, but hits harder. At deceleration of 4G, easily possible in a collision, even strong man can't brace himself effectively.

Belt and shoulder harness provide the best protection in a crash. This is how the Thin Man ended up after a simulated 4G crash. No injuries except perhaps a few bruised toes.



Catapulting car used in the Cornell Aeronautical Laboratory tests. When release is triggered, elastic cords jerk car back. Effect is to provide desired deceleration, though it is actually acceleration. Test lasts only fraction of a second, but shows what would happen to human body in crash. Made of sheet metal, Thin Man is crashproof in the laboratory trials.

material that crushes under a blow and either does not recover or recovers slowly. Ordinary live rubber is not recommended because it stores the energy of a blow and throws the head backward. Along this line, however, several rubber companies are experimenting with a slow-recovering rubber that will absorb the force of a blow and return to its original shape over a period of time.

Some kind of body restraint should also be provided. This can be in the form of seat belts and shoulder harnesses having a breaking strength better than 4,000 pounds, or cushioned body-control panels that can be pulled out to restrain the passengers in the front seat and be pulled down from the back of the front seat to restrain the passengers in the rear seat. The latter could be designed to yield a foot or so under a uniform force of about 4,000 pounds.

Still another form of safe body restraint could be obtained by placing as many seats as possible so that they face the rear. Any forces due to a crash then would be distributed evenly over the backs of the passengers.

In the driver's seat, the steering wheel is, paradoxically, both a hazard and a protection. It is the cause of most driver injuries. At the same time, its protection is seemingly responsible for the lower fatality rate in the left front as compared to the right front seat. In a bad crash, the driver may get serious chest injuries from the wheel, but the person alongside may be killed by smashing his skull on the dash or windshield.

Dye and his Cornell associates have two thoughts about preventing wheel injuries. One is to eliminate the steering wheel entirely, substituting steering levers that would control a hydraulic steering system. The

other is to provide a steering post designed to yield under impact loads of 500 pounds or more. This could be accomplished through the use of shear pins that would allow the telescoping steering column to collapse. This and other design ideas are shown in the drawings on the following two pages.

Since the force of a crash is equal to the kinetic energy $\frac{(\text{mass} \times \text{velocity}^2)}{2}$ divided by the distance traveled during the period of deceleration, the Thin Man experimenters recommend that, for maximum safety, an automobile should be designed to have the major portion of its weight ahead of the passenger compartment, and that the structure between the passengers and the front of the car be designed to crumple progressively. This would *increase* the distance over which the crash deceleration is accomplished and therefore *decrease* the crash force. Also, the front structure should be so planned and fabricated that it will collapse out, rather than in, to prevent passengers from being pinned inside.

When You See a Crash Coming

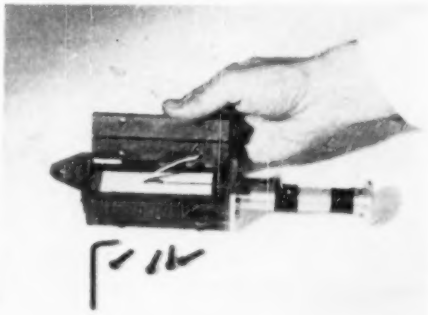
From the Thin Man's many bloodless laboratory crashes have come some basic "what-to-do-if-you-see-a-crash-coming" suggestions. If followed, they can mean the difference between your life and your death.

First of all, don't do the instinctive thing. Don't throw your arms up to protect your face. The bulk of your up-raised arms will only add to the weight of the upper part of your body and increase the force of the hammer blow when your head and arms hit the windshield or the dash. Instead, cradle your head in your arms to cushion it and press it firmly against some solid forward structure. If you are in the back seat, this will mean the back portion of the front seat. If you are in the one next to the driver, it will mean pressing your arm-cushioned head against the smooth part of the dashboard. The driver, naturally, should try to control his car as long as possible. However, the steering wheel can provide him with some support if, at the last moment, he cushions his head with a forearm and presses it against the wheel.

If you follow the advice of the Thin Man, however, you'll use seat belts. Get them from an aircraft-belt manufacturer, and install them exactly to his specifications. Then *insist* that every passenger use them if he wants to ride.

Pencil leads and an electrical sparking system provide data in crash tests. Leads trace paths of joints on paper background, while sparks puncture paper to provide timing marks.

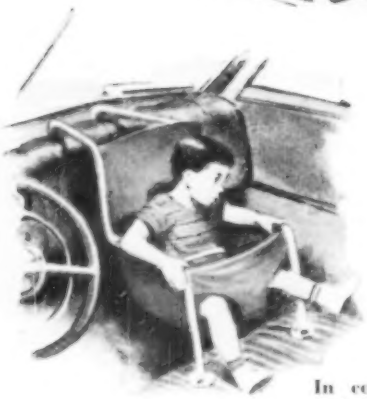
Thin Man's muscles can be "flexed" to simulate any degree of human tenseness by adjusting tension bolts at joints with the aid of a wrench and a sensitive spring scale.



Force of impact of Thin Man's head is measured by gauge. Force pushes blades to cut cardboard inserts. Depth of cut indicates energy of blow. *[Continued on next page.]*

How Cars Can Be Made Safer

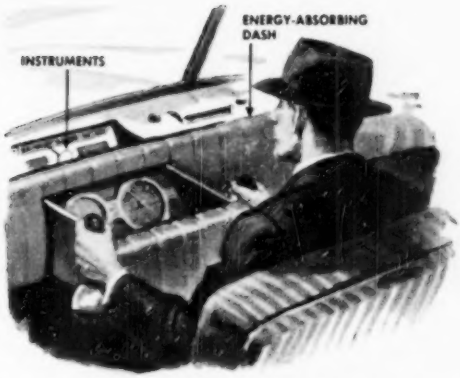
Good crash safety could be obtained, suggests Cornell's Edward Dye, if all seats except the driver's faced the rear. Driver could use a body-restraining device.



Youngsters could ride comfortably and safely in a rearward-facing baby seat attached securely to the dashboard and having feet resting on the front seat. When not in use, it could be removed and stored.

In conventional cars, best protection against injury in crashes is a well-designed seat belt and shoulder harness similar to those recommended for use by airplane pilots. To be safe, the web straps should have a minimum breaking strength of at least 4,000 lb. and be anchored accordingly.

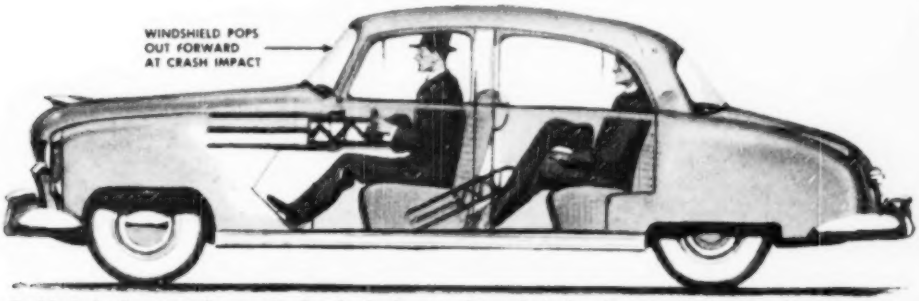
Next best is a seat belt without the shoulder harness. It should be installed so it meets the body at an angle of 60° from the horizontal, and should be adjusted to allow about 3 in. of hip movement. Head may still strike dash, but without dangerous body momentum behind it.



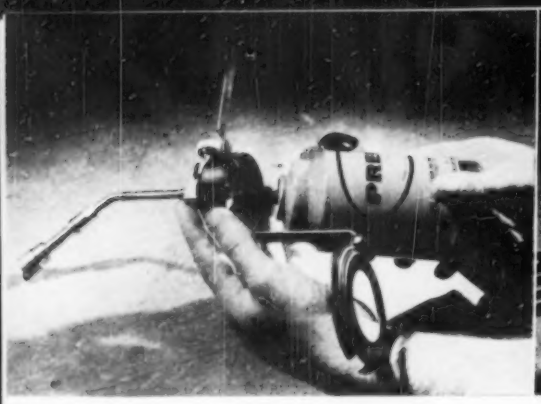
Steering levers could replace the steering wheel and eliminate the major cause of injury to drivers. Driver could be restrained by an energy-absorbing panel pulled out from dash.

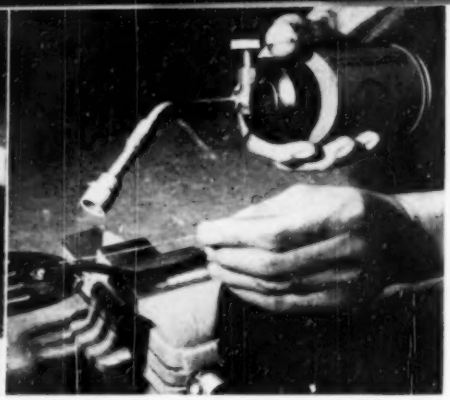
Conventional steering wheel could be made safer by providing it with shear pins designed to yield under an impact load of 500 lb. Wheel would give gradually to absorb shock.

Heavier car frames and a built-in roll-over frame would increase the safety factor in car accidents. Side frames could be strengthened to provide adequate protection in case of side-swiping smash-ups. If the front ends of autos were built to crumple progressively, and collapse out, rather than in, there would be less chance of injury in bad car crashes.



Padded body-control panels for both front and rear seats plus steering levers would provide safety for driver as well as passengers. Individual energy-absorbing panels could pull out from dash for driver and death-seat passenger, while section of the back of the front seat could pull down to restrain the passengers in the rear seat in the event of a crash.





Cartridges Load Blowtorch

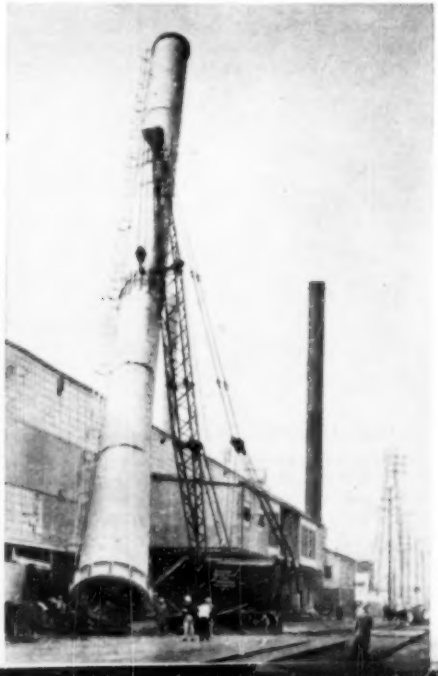
A THROWAWAY can feeds the fuel into this new pumpless blowtorch. When one can is empty, you replace it with a full one, turn a valve, and the burner lights instantly at the touch of a match. Called Prepo, the torch consists of a burner and valve assembly that clamps over the top of the fuel container (left above). The fuel, a highly volatile compound of hydrocarbons, builds up pressure inside the can to force vapor out through the burner. Burning with a clean, blue flame at 2,200° F., the torch handles a wide variety of jobs, including silver soldering (right above). Made by Pressure Products Corp., Chicago, it sells for $5.95. Refill cans, costing 89¢, last five hours.

Powered Broom Sweeps Lawn

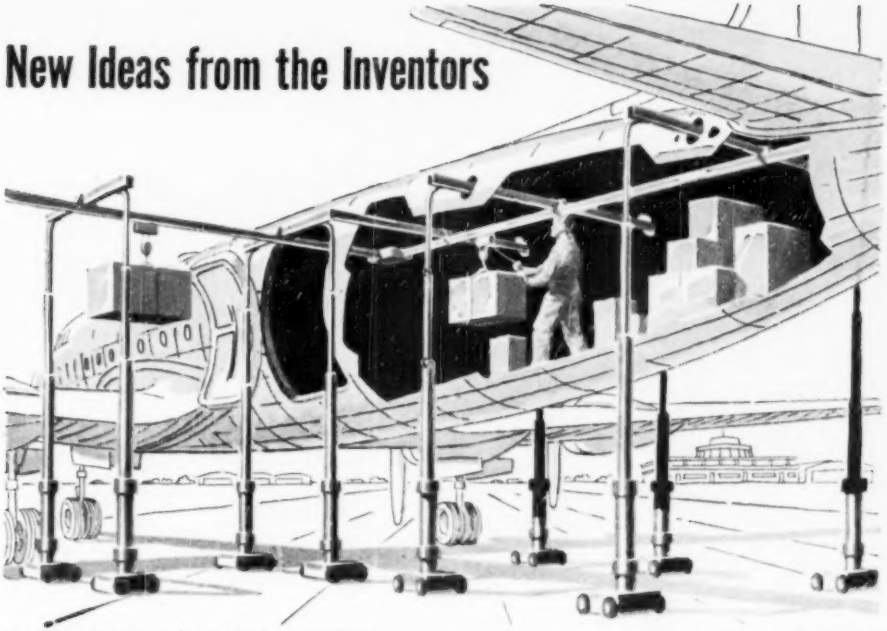
YOU can sweep your lawn as easily as you do your floors with the motorized lawn sweeper shown below. Powered by a single-cylinder, four-cycle gasoline engine, it has a 28-inch-long rotating brush that picks up leaves, grass cuttings, stones, paper, and other trash and tosses them back into a 10-bushel basket. Made by the Parker Pattern and Foundry Co., Springfield, Ohio, the sweeper rolls on dual rubber tires.

Smokestack Gets Big Lift

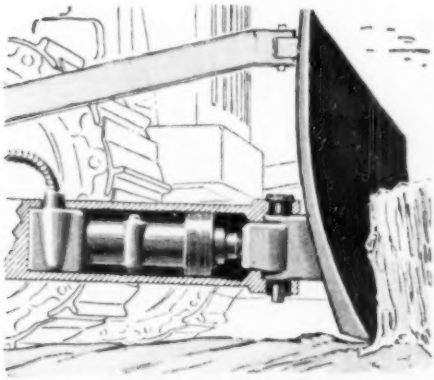
MOST smokestacks are built piece by piece from the ground up, but the giant structure below was assembled in one piece on the ground, then lifted by a crane to its vertical position on a concrete foundation. Once standing, the 26-ton steel stack was lined with 124 tons of fire brick and mortar. Built for the Los Angeles plant of the Bethlehem Pacific Coast Steel Corp., it carries hot gases 150 feet into the air.



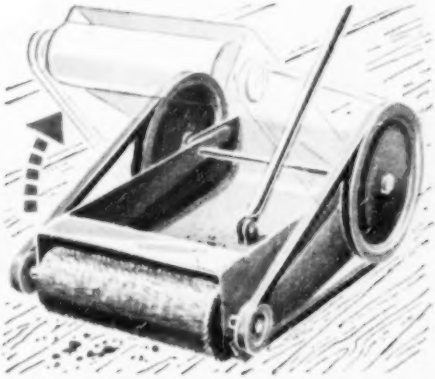
New Ideas from the Inventors



1 MONORAIL TO LOAD PLANES. A cargo plane could be loaded and unloaded quickly and easily with this take-down monorail system. Wheeled uprights would be moved into place to support the monorail within the plane through openings in the fuselage. They would also hold the loading rail that leads through the plane's big loading door. Loading or unloading completed, the monorail system could be removed.



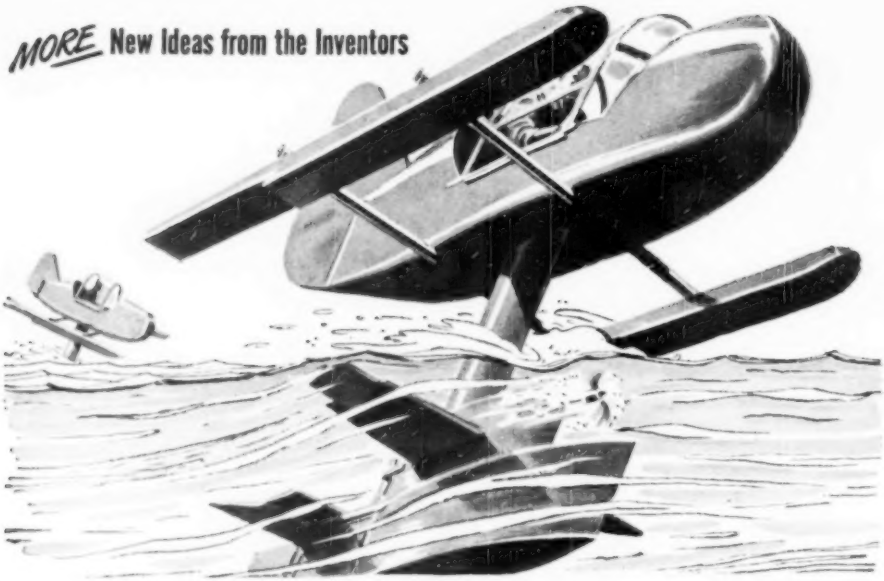
2 AIR HAMMER FOR DOZER BLADE. Stubborn stumps or boulders would be a pushover for a tractor equipped with a blade backed up by this air-hammer attachment. All the driver would have to do is turn a valve. Then the air hammer, by pounding the blade with rapid-fire blows, would help it work the obstruction loose.



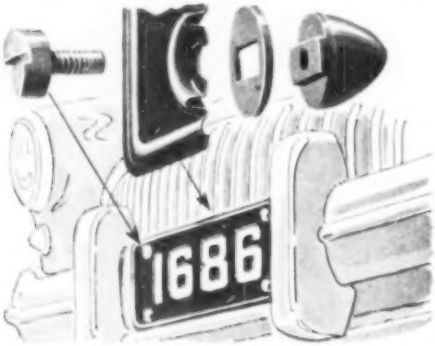
3 DUSTPAN HAS OWN BRUSH. A cross between a dustpan and a carpet sweeper, this new cleaning tool is designed to eliminate stooping when sweeping up piles of dirt. Its rotary brush is belt-driven so that it turns rapidly when the pan is pushed forward. When the dustpan is dumped, the brush is easily raised out of the way.

Turn the page, please, for three more new ideas.

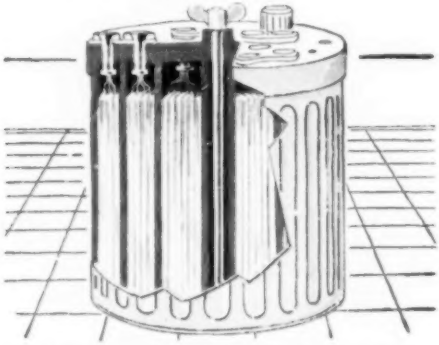
MORE New Ideas from the Inventors



4 DEVICE SIMULATES SEAPLANE. You could have the thrills of piloting a real seaplane with this aquatic device. Designed for either amusement or training, it is driven by an underwater, gas-engine-powered propeller. Conventional aircraft cockpit controls operate water rudder, ailerons, and elevators. By manipulating them the "plane" can be made to take off, bank, and land realistically.



5 TAG FOILS THIEVES. This license can be attached with a screwdriver, but must be destroyed to take it off. The bolts have one-way slots, can be tightened but not loosened. Deep embossing of the tearout disks shield the bolts so you can't grip them. Tapered, shouldered nuts give no wrench purchase. You remove the license by ripping it off, then squeeze the disks against the sides of the bolts with heavy pliers, and turn.

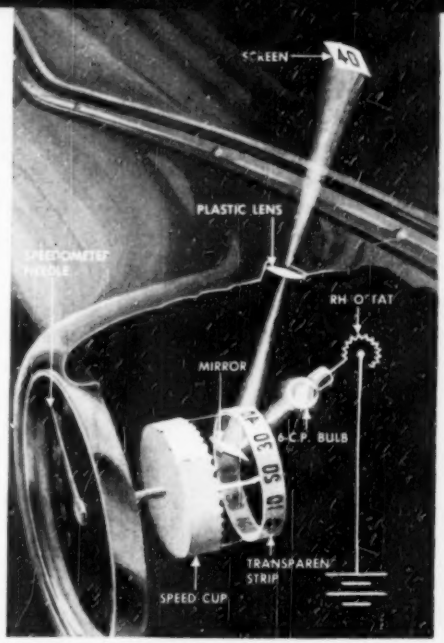


6 ROUND BATTERY SAVES SPACE. Three concentric cells nested together make a compact storage battery for autos and other vehicles. Cylindrical walls separate the three cells, and are so spaced that each cell has the same battery-acid capacity and cell-plate area. The cylindrical shape of the plates gives a larger area and therefore greater capacity than conventional rectangular plates.

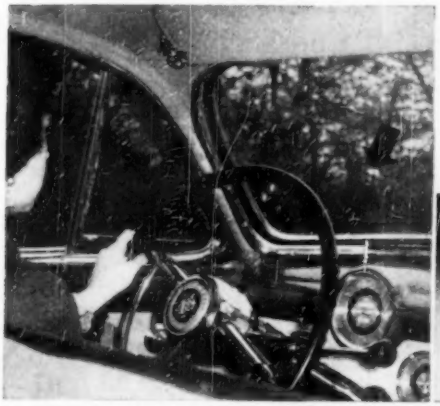
Patents on these inventions have been granted to: 1. G. Neville, Van Nuys, Calif.; 2. B. Alderman, Eugene, Ore.; 3. V. Filonowicz, Detroit, Mich.; 4. E. Link, Binghamton, N. Y.; 5. W. Martin, Tampa, Fla.; 6. J. Rupp, Williamsville, N. Y.

Speed Screened On Windshield

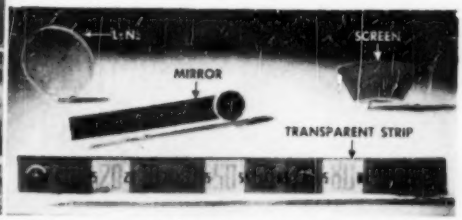
YOU don't have to take your eyes off the road and check your speedometer with this Glowmeter. Attached to any standard speedometer, it shines an image of your speed right on the windshield. As the speedometer shaft turns, moving the needle, it also rotates a drum-mounted transparent strip of numbers, synchronized with the speedometer-face numbers. A light reflected through the strip by a mirror projects an image of the numbers through a lens in the dash cowling, and onto a tiny metal screen fixed to the windshield.



Cutaway drawing shows how speed figure is projected on dime-size windshield screen. Glowmeter Co., Buffalo, N. Y., developed the device.



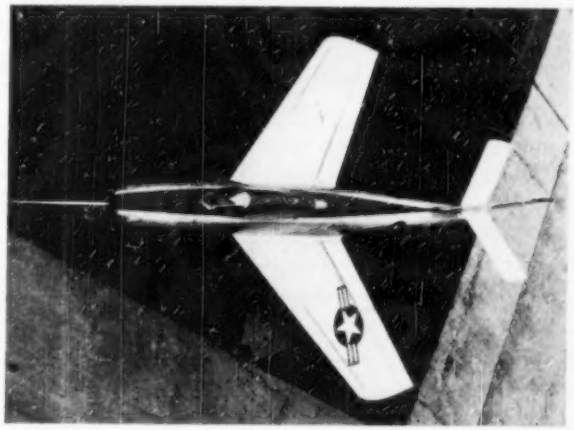
Arrow points to tiny screen on which speed is projected. Image changes color (blue, red, yellow) with every 10-m.p.h. variation in speed.

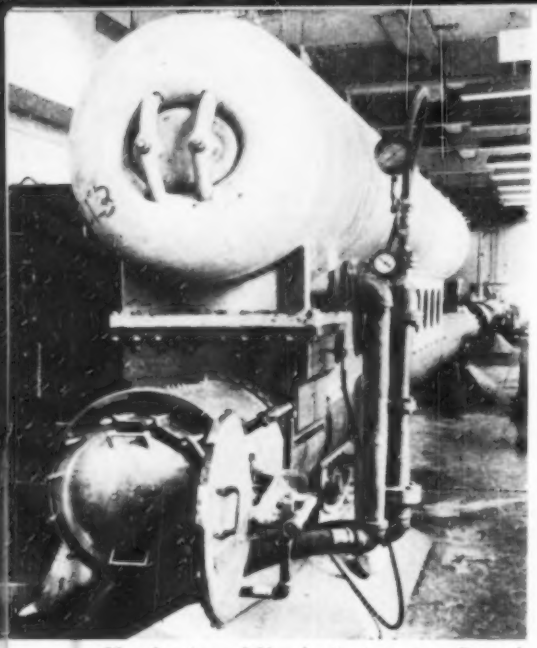


Main parts of the Glowmeter are shown actual size above. At left of mirror is bracket that holds it in place. Plastic strip is multicolored.

Thunderjet Tries New Swept Wings

SWEPT-BACK wings and a new tail assembly give a sleek look to the revamped Republic Thunderjet shown at right. Inside there's a more powerful J-35 turbojet engine, and greater fuel capacity. Added up, these innovations will enable the new Air Force fighter, the YF-96A, to fly faster, farther, and higher than its 600-m.p.h. predecessor. It also can carry more external bombs, rockets, or guided missiles.



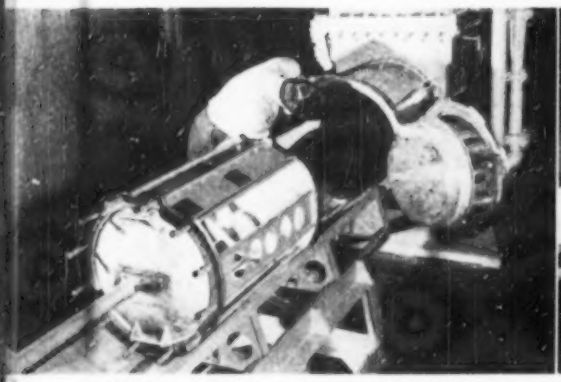


Muzzle view of Navy's giant air gun. Big cylinder on top of tube is muzzle chamber. It provides extra air volume in front of piston, acts as cushion to help cut down oscillation.

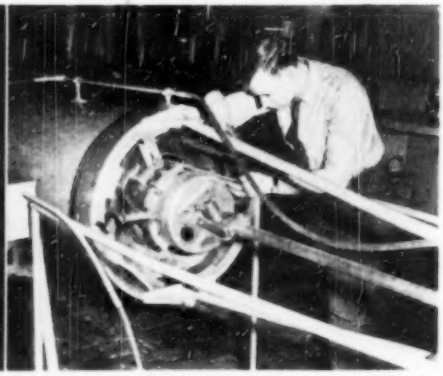
Giant Air Gun Jolt-Tests Fuses

THIS king-size air rifle is used by the U. S. Navy to test shock effects on mine and torpedo fuses. The Navy wants to know whether a mine sown from a plane at 30,000 feet will still function after it has hit the water. So it simulates the shock by firing the fuse-mechanism down this 21-inch-diameter, 93-foot-long steel tube.

The device being tested is mounted in a cylindrical frame that serves as piston, or "bullet," for the gun. The piston is loaded into the muzzle and pumped by low-pressure air to the breech end. Here it engages a complicated release mechanism, which locks it in place until the right amount of air pressure is built up behind it. Then a hydraulic trigger releases the piston and it flies down the barrel. It builds up air pressure in front of it which finally pushes it back toward the breech. It oscillates in this way until the available energy is used up in friction or trapped in a muzzle chamber.

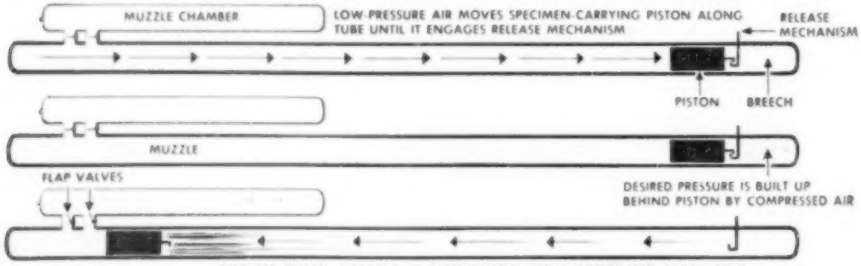


Getting muzzle ready to receive piston. Keyway on piston fits multiple-contact electrical strip running length of barrel. This allows readings while the piston is in motion.



Breech view of gun. Hydraulic device locks piston into place until desired air pressure is built up behind it. Amount of pressure depends on number of G device is required to stand.

Diagrams show how gun works. Gun can exert forces equal to 2,750 G on a five-pound load.



RELEASED PISTON IS FORCED TOWARD MUZZLE. AIR IS COMPRESSED AHEAD OF IT AND ACTS AS BRAKE, SUBJECTING TEST SPECIMEN TO DESIRED NUMBER OF G. MUZZLE CHAMBER TRAPS SOME OF THE AIR AHEAD OF PISTON, HELPS SLOW IT DOWN.

Darning Needle Dwarfs World's Smallest Screws

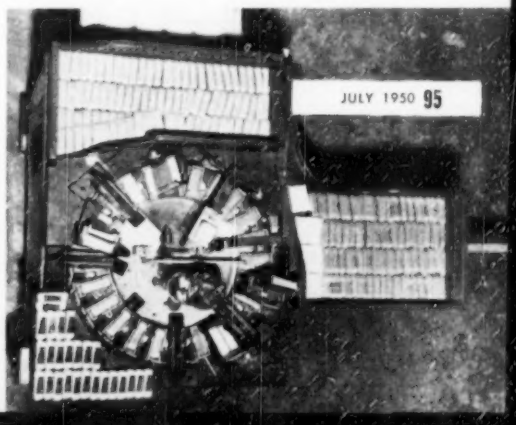
THE picture above is a photomicrograph of the world's smallest mass-produced screws. Perfectly threaded and slotted, they are so tiny that they can almost pass through the eye of the darning needle shown in the foreground. It would take a million of them to tip the scale at one pound. They are used to adjust the delicate balance wheels in precision watches and military timing instruments. The microscopic screws and the machines that make them were developed by the Elgin National Watch Co.

Machine Makes Ice Cubes Fast

THIS new ice-cube dispenser, invented by comedian Lou Costello, makes 360 cubes in 90 minutes. Riding on a conveyer belt, water-filled steel trays pass through the freezing unit, and then to the dispensing outlet. Pressing a glass down on a trigger release sends the cubes, one at a time, sliding down a chute and into the glass. Called Serv-Ice, the dispenser was developed for use by hotels, restaurants, bars, and hospitals.

Wheel Assembles Harmonicas

FIRST of its type, the automatic assembly wheel below turns out 3,600 harmonicas an hour—a production increase of 2,800 percent over the previous rate of 130 an hour. As the wheel revolves, the five parts of the all-plastic harmonicas drop from hoppers, one by one, building up a sandwich, while glue is squirted in to "weld" them together. The machine was developed by the Magnus Harmonica Corp., of Newark, N. J.



Atomic Air Wardens'

While firemen of the Oak Ridge National Laboratory fight smoke and flame in mock fire,

Geigermen lead fire fighters through "hot" area after mock A-bomb blasts buildings in realistic training test.

> "The real strength of America is not in bombs or planes, but in the resourcefulness of its people. . . . Americans who know how to handle cameras can easily learn to handle Geiger counters."
>
> **—Murray S. Levine,**
> *formerly of Manhattan (A-bomb) Project, to Joint Congressional Committee on Atomic Energy.*

By Michael Amrine
PS photos by the author on location

OAK RIDGE, TENN.

MY assignment was to cover a fire.

To a reporter who has eyewitnessed some pretty spectacular displays of flame and smoke, from the Kansas City stockyards to the New Orleans waterfront, this *looked* like any ordinary one-alarm blaze in a frame shack on the edge of town.

But I had never covered a fire like this one.

I stood on a small rise of ground just two miles from the Oak Ridge nuclear reactor that manufacturers U-235 for the atomic bomb. And my ears were cocked for something more significant than the sound of crackling flames and screaming sirens—the barely audible buzz of the nearest Geiger counter.

For this sudden blaze, which destroyed a "communications center" and threatened nearby buildings, had burst out in an area already "hot" with radioactivity.

A Geiger squad of twenty men, wearing gas masks, and carrying instruments of half a dozen different types, were on the scene *before* the firemen. As the sirens spiraled down to a low whine and the pumpers lumbered to a halt in the muddy field, the Fire Chief reported to the leader of the Geiger squad.

That was the thing that struck me most vividly in contrast with other fires. The senior fire officer ordinarily has authority equaled only by the captain of a ship. Here, the Geiger captain, with a survey

First Workout

student air-raid wardens of the atomic age battle the even deadlier "heat" of radiation.

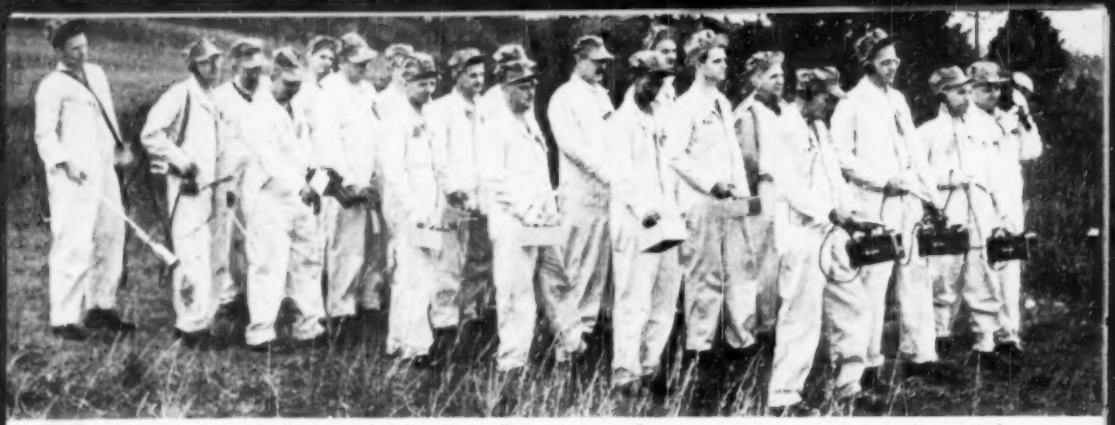
instrument in hand, went ahead as he led the Fire Chief off at a dead run to take a quick look at the terrain. The firemen could not do their jobs without checking with the Geigermen at every turn. They reminded me of Seeing Eye dogs. They were no more immune to radiation than you or I. But they had electronic eyes and ears which could see through smoke and feel radiation through several feet of earth.

What these white-clad Geigermen were learning may some day save your life, in your own city, if the human race should ever be so foolish as to wage an atomic war.

The fire was real, and the radiation was real, but it was all prearranged—the first public field exercise of the first class of radiation monitors trained for civil defense of America's cities. It constituted the final exam of a five-weeks course of instruction.

The burning "communications center," the "powerhouse," and the "waterworks" (which contained a tank of "hot" liquid) were one-story shacks designed to represent larger installations that may some day be atomic targets in your own back yard. The fire was "planted" by instructors from the

Students check equipment before entering contaminated area. Men wear white cotton gloves and gas masks. Instruments must be zeroed to normal background count of area.



The 20 students line up, led by the walkie-talkie operator and a battery of Geiger counters—the black boxes with the metal tubes. Geigers are good for detecting presence of radiation but give only rough idea of amount. The light-colored boxes are used for one-handed operation and more precise measurement. A man in second rank from rear has pistol-grip "cutie-pie"—with the black, oversize barrel—for gamma rays. At extreme left is fish-pole probe, which precisely measures high gamma radiation and indicates roughly the presence of beta radiation.

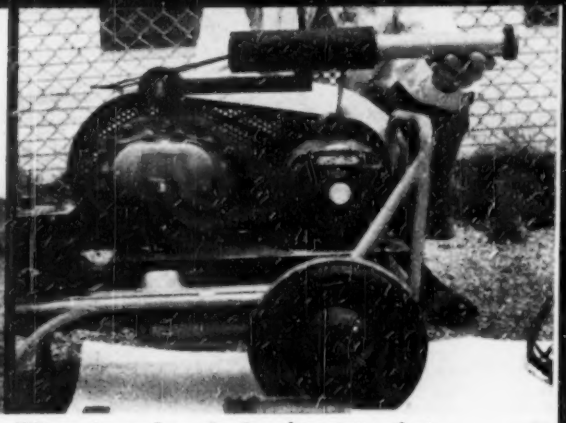
health physics training divisions of Oak Ridge Laboratory and Oak Ridge Institute. The 20 students were sent by the governors of 16 Southern and Midwestern states for the five-week basic training course, sponsored by the Atomic Energy Commission and the National Security Resources Board, an agency which reports directly to the White House. They were being taught not only to know radiation but to train others.

This summer, NSRB is sponsoring two more of these courses for specially selected trainees at Brookhaven National Laboratory on Long Island and at the University of California at Los Angeles.

At Oak Ridge the 20 chemists, engineers, physicists—and one veterinarian and one short-wave radio operator—learned the

As fire dies out, monitor (center, below) moves in close for a reading. Concentration of 9,000 milliroentgens made this spot the hottest by far in entire area, due to radioactive paint and buried radioactive cobalt. Next day, with the cobalt safely behind lead bricks, the charred timbers still gave off 100 mr per hour. Tolerance dose for the average man is 60 mr per *day*.

Geiger-counter man acts as "Seeing Eye dog" for radio operator. Person without detection equipment is blind for all practical purposes while in contaminated area. He can't see, taste, smell, or even feel deadly radiation until two weeks too late for him to do anything about it.

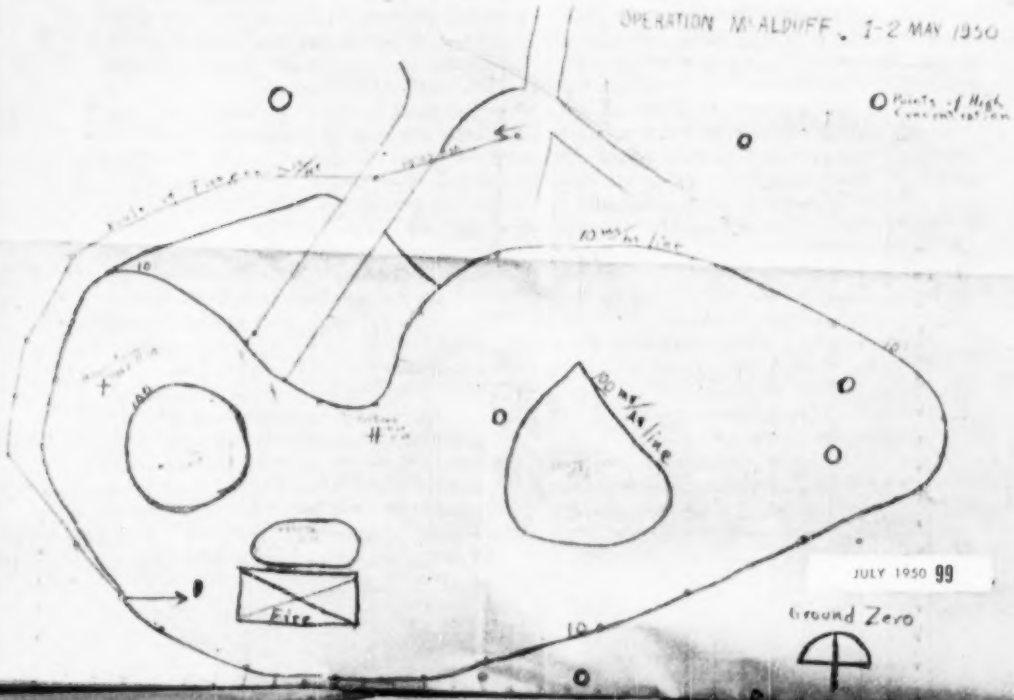


Filtron is used to check radioactivity of air. Portable generator sucks five cu. ft. of air per minute through tube containing porous cardboard cylinder, which filters out any radioactive dust from air. Tube is then checked with Geiger counter and extent of contamination computed.

hard way. Students themselves planned the operation in outline, led by instructors Dr. Ralph T. Overman and Dr. Elda Anderson. Some of the men were battle veterans who gratefully remembered their Army basic training exercises—for example, the "infiltration course" in which troops crawled on their bellies over the ground beneath a hail of live bullets.

At Oak Ridge they used live bullets of radiation—alpha, beta, and gamma particles. Dr. Anderson put a bandanna over her gray locks, climbed into a pair of blue denims, and spent a rainy week-end seeding the area with hot materials. Three "curies" of radio-cobalt were buried several feet in the earth. Radioactive potassium bromide was scattered over the earth's surface, and solu-

Map below shows how data is plotted. Outer line shows comparatively low reading of 10 mr per hour. You could stay here six hours without getting overdose. Hot spot shown on opposite page is plotted on map just north of communications center. Single line with cross-marks gives filtron reading after fire. Air-sample readings indicate that all is clear at that point.



Firemen brought the blaze under control in an hour, even in the face of a brisk wind. Hose line shown here closely follows line charted on map by remote plotters, from data radioed back by monitors. Sensitive counters found "dent" in radiation through which fire could be reached.

tions of it were applied with brushes to the walls of buildings and to scraps of debris.

Zero hour at 10 o'clock next morning was signaled by smoke bombs that wrapped the buildings. Four minutes later, flames appeared and the class went into action.

Under strictest instructions not to enter the "hot" area, I watched from across 200 yards of innocent-looking grass emitting perilous rays. Even before I could report to the scene I'd had to don white coveralls and slip on rubbers—I was to carry away no trace of mud from the scene. The famous mud of Oak Ridge was not only sticky that day—it was loaded.

Geigermen told me bluntly where to walk and how close I could get. I was willing to take orders. As a reporter I've taken my chances in burning buildings—but here, your eyes and ears gave no warning.

Three squads, into which the class was divided, took turns working in areas. They carried not only Geiger counters but half a dozen other instruments to detect and measure radiation.

First a "survey" meter nosed out the rough outlines of the hot spots. This could be done almost on the run. Then came instruments to measure the precise amount.

When a middle-aged veteran fireman of the Laboratory Fire Department was overcome by the heat, the trainees had an acid test of their coolness and skill. It took a half minute to realize this was not a prearranged part of the test. Then the squad on duty monitored his boots and gloves as he was carried from the field. They wanted to know not only whether radiation was there—but just how much, and no mistake.

The fire was brought under control within an hour. Only wisps of smoke appeared after that time, but for another hour and a half the counters buzzed and the trainees took hundreds of readings. Everything leaving the contaminated area had to be checked. Rubbers or boots sticky with menacing mud, mine among them, were left behind at Oak Ridge as the exhausted trainees and firemen left the area.

Next day the lessons of the exercise were

Besides Geiger counters, atomic air-raid wardens need plenty of ordinary wrapping paper. Paper protects equipment from alpha particles, which have such low penetrating power that they can't pierce human skin. Equipment must be kept off ground, especially when it's muddy.

During decontamination process, tires and chains of fire-fighting equipment get a thorough going-over from the electronic eyes and ears of trainees. If a fire hose is lying in dry grass, it needs little attention. If in a puddle of water, it must be monitored for radioactivity.

On decontamination day, radio operator reports 100 mr reading from powerhouse ruins. That means a repairman could stay there only 30 minutes a day. Anyone trapped for several days would be in bad shape. But only a very low-level bomb burst would produce this effect.

Neutron detection is tough, usually must be done indirectly. Here a sheet of photographic film sandwiched between sheets of aluminum foil is placed on ground. Plywood weight keeps it from blowing away. After exposure of an hour or so, neutron radiation shows on film.

driven home when observers were permitted to enter, with the squads, on their follow-up mission of decontamination.

Gas masks were not necessary. Air sampling had given an "all clear" reading the day before. But all the rest of the equipment was used again. Main task was to dig up the extremely hot cobalt and put it securely away in improvised safes of lead bricks. The crews also went over samples of glass, steel, plastic, and other materials with various cleaning agents. The agent used does not matter much, and water and elbow grease are as efficient as any. *Nothing* is sufficient on any porous material.

Besides coveralls and rubbers, this time they also suggested I wear white gloves. When I told them I couldn't work my camera with gloved fingers, they let me go bare-handed. But I was cautioned to touch nothing, not even a blade of grass.

Gingerly I followed Dr. Overman and our Seeing Eye Geigerman into the muddy area. "Watch out!" a Geigerman shouted at me. I had momentarily forgotten my instructions and started to put my camera on the ground, preparatory to changing film for a new group of shots. Nothing could be permitted to touch the ground unnecessarily. As for the camera, the nuclear radiation would fog my film as surely as if I unfurled a roll to the sun's visible radiation.

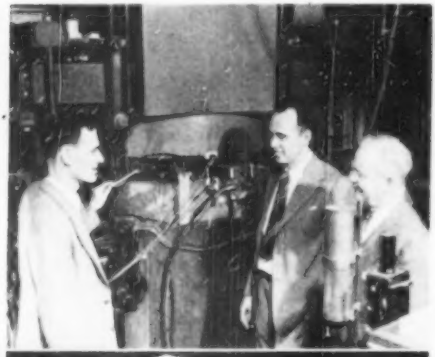
I took a few photographs of the mopping-up operation. I wasn't sorry to be told, then, that the 45 minutes of permitted time had elapsed and that I and my "watchdog" would have to leave.

As I took a last look at the charred timbers of the rehearsal fire—still glowing with unseen atomic disintegration—I fervently hoped we would never see an American city shattered by a real bomb, blasted and poisoned by these elemental forces.

Paul J. Larsen, director of NSRB's agency of Civil Mobilization, emphasizes that advance planning under way for civil defense does not mean that the government feels war is close or even probable. But it knows that Pearl Harbors are the result of unpreparedness. END

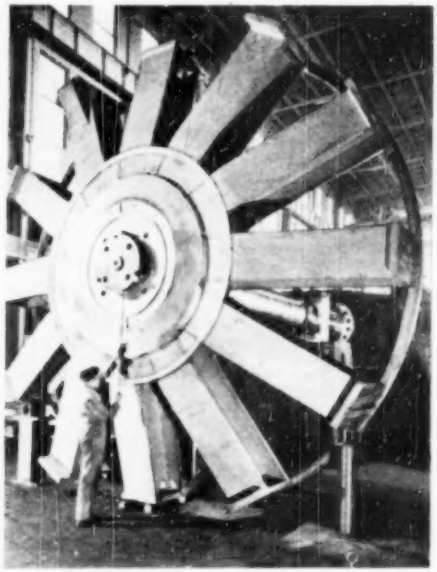
Jet Flying Wing Reports for Aerial Photo Duty

THIS latest version of the Northrop Flying Wing, the YRB-49A, is designed for long-range, high-altitude, photo-reconnaissance missions. It's powered by six J-35 turbojets, each delivering 5,000 lb. of thrust. Four engines are mounted in the wing, two more in pods slung beneath it. Performance has not been announced, but a predecessor, the YB-49, set a jet endurance record in 1948—3,701 miles nonstop in nine and a half hours. The same plane was said to be in the 500-m.p.h. class at 35,000 feet.



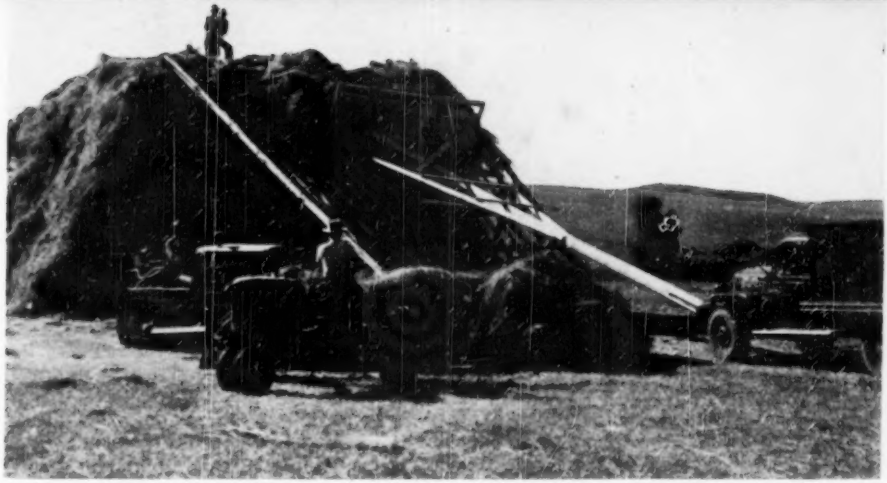
New Beam May Cure Disease

APPLYING high-speed electrons directly to cure disease, a promising innovation in therapy, will be tested with the GE synchrotron in top photo above. Its electron beam, which made the imprint above on a photo film between wooden blocks, can attain 70,000,000 volts and is believed the most powerful ever led into open air. Turned directly on a surgically exposed tumor, instead of aimed at a target to produce X rays, the beam provides radiation as intense as X rays but without harmful penetration.



More Power for TVA

WHEN completed, this giant rotor spider will help furnish more hydroelectric power to the territory served by plants of the Tennessee Valley Authority. The spider will be installed in a new 13,800-volt vertical generator at TVA's Wilson Dam. The generator will be coupled directly to a 35,000-hp. hydraulic turbine, one of 18 that eventually will be in operation at the dam. Immense size of the partially completed rotor is indicated by comparison with height of workman adjusting the intricate machinery.

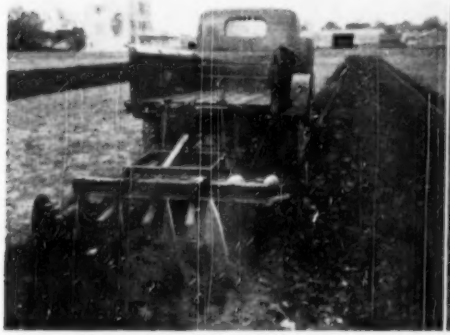


At haying time the Dodge Power-Wagon saves backbreaking labor. Here a homemade wooden ram, mounted on the front bumper, easily pushes several hundred pounds of hay up a rack.

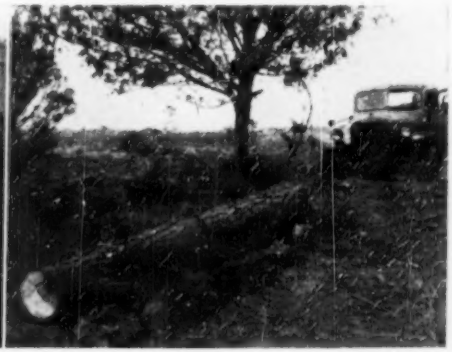
A post hole is dug in 20 seconds, as the hydraulic lift forces the digger downward, while power from the engine turns the bit. Rear take-off also powers other belt-driven equipment.

Hydraulic Lift Added to Truck

A HYDRAULIC lift and a power take-off make the 94-hp., four-wheel-drive Power-Wagon, recently announced by Dodge, a jack-of-all-trades around a farm. A belt drive from the engine operates a front-mounted hydraulic pump. This transmits fluid pressure to a cylinder at the rear that powers a lift designed to pull, lift, and operate any three-hitch implement. It also will apply down pressure up to 500 pounds to force an implement into the ground. The power take-off can run any sort of belt-drive equipment, according to Dodge. The truck body has a 58-cubic-foot capacity.



Some 500 pounds downward pressure can be exerted on plows, harrows, or earth-diggers. Finger-tip controls in cab allow raising implements hydraulically to clear rocks and stumps.



A 7,500-pound capacity power winch, driven from the front power take-off, has 250 feet of 7/16 inch cable for many farm, construction, and lumbering jobs, such as pulling logs, above.

World's first automobile air ferry uses this motorized ramp to speed loading and unloading.

World's First Air Ferry for Cars

Air freighters and a novel loading ramp combine to speed motoring tourists across the English Channel.

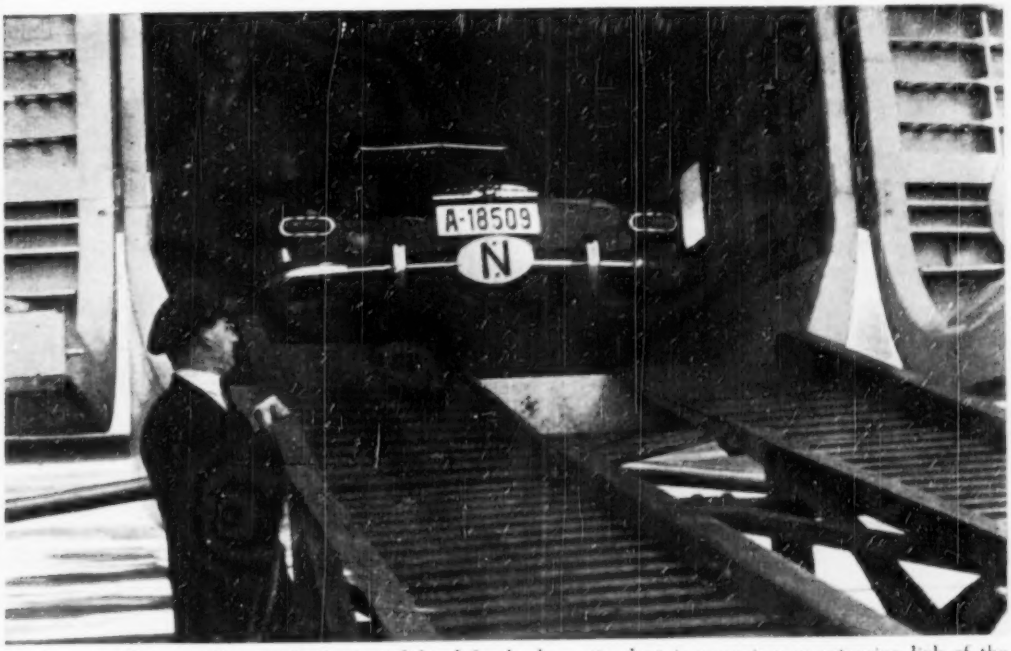
By Devon Francis

RIGHT after the war was over, a chap who had served as an officer in Britain's Royal Air Force fell to wondering what he could do with airplanes that nobody else was doing. After a lot of deep thinking he came up with the answer: Why not air-ferry automobiles where automobiles couldn't be driven? Specifically, an over-water air hop to the European continent? That wouldn't be hard, with the Continent only the width of the English Channel away.

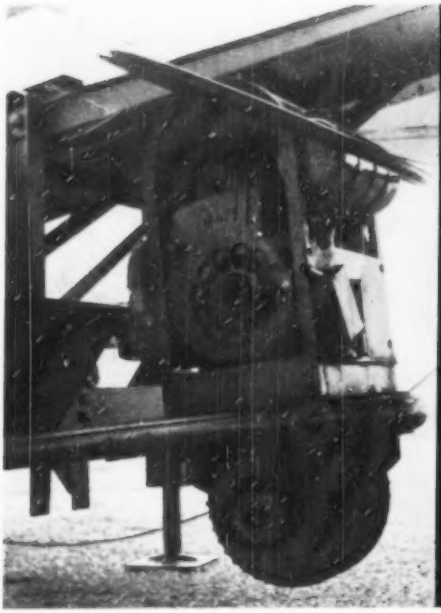
Today Silver City Airways, of London, headed by Air Commodore Griffith Powell, is shuttling thousands of cars across the channel each tourist season. The flight of 42 miles, from Lympne airdrome in England to Le Touquet, France, takes 20 minutes. The price for a good-size car is about $89, and four passengers ride for free.

The real trick in the deal is a motorized ramp that can be put in place in two minutes flat. Loading takes about a minute.

Cars are driven into maw of Bristol Freighter under own power. Airplane can take two cars.

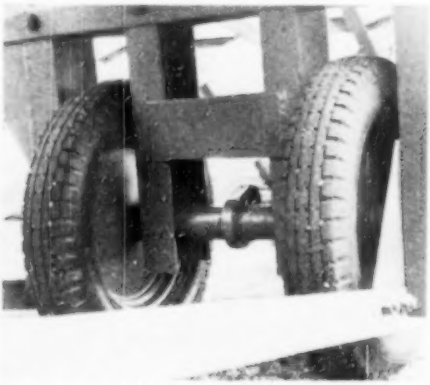


Ramp rolls on wheels, is stabilized for loading and unloading with jacks. In photo above attendant is removing an extension link of the ramp's track. *[Continued on next page.]*



This is a close-up of ramp jacked up against plane. Front wheel is lifted clear of ground. Ramp's length is 20 feet and extension links 6 feet. Chief advantage of air-ferrying cars across channel is saving of hours of time in boat travel. Planes used are twin-engined.

Ramp's motive power is 2½-hp. 2-cycle engine. Driver has only one control. By pivoting steering wheel downwards he opens throttle and engages clutch. Raising wheel closes throttle, disengages clutch, applies brake. He reverses direction by turning wheel around.



Two pairs of double 18-inch wheels (above) support rear of ramp for wheeling around airport. Wheels have plain axles and are not sprung. Ramp's maximum speed is 5 m.p.h. Company expects to ferry 5,000 cars this summer season.

Jacks (left) are raised and lowered by hand. At workman's right is one of ramp's two extension sections. A dozen versions of ramp were built before design was adopted. Silver City Airways has been ferrying cars for three years.

Mobile Light Protects Kids

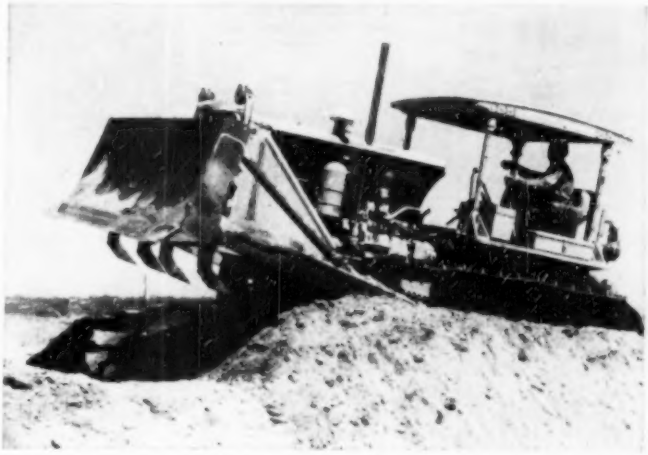
For street crossings near schools and at places lacking permanent lights, this mobile battery-operated traffic light is easily rolled where and when needed. Mounted on a small, two-wheel truck, the light pole can be dismantled and stored in the battery case when not in use. A "school" sign or conventional red and green signals can be adjusted to operate steadily or to flash at intervals. Streeter-Amet, Chicago, makes it.

Toy Shovel Hooks on Tricycle

A digging toy to delight any child is this Trike Shovel, which hooks onto the handlebars of a tricycle. Worked by two rubber-covered levers, the shovel actually digs, scoops up sand or dirt, and dumps it wherever wanted. Left-hand lever swivels the shovel to either side; right-hand lever scoops bucket through sand and raises it to a position where a chain automatically opens and dumps the bucket. Made of aluminum, the toy is sold by Miles Kimball Co., Oshkosh, Wis., for $2.95.

'Dozer Fangs Rip Up Rock

The four curved shanks attached to the moldboard of bulldozer at right are capped with steel-alloy teeth. Back up the 'dozer, and they rip up rocks and hard ground. The attachment doesn't interfere with normal blade operation, and can be locked out of the way when not used. Back Rip Scarifiers are made by Preco Inc., Los Angeles.



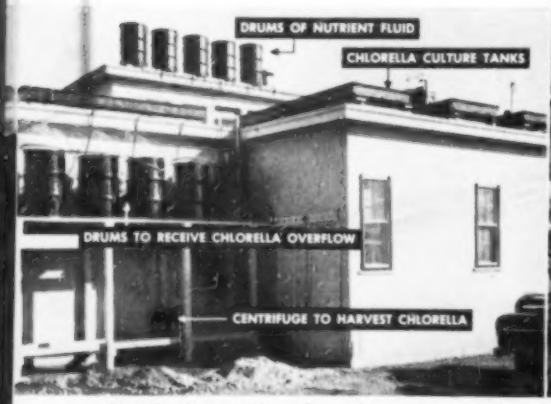
Harnessed Sunlight Grows Food by Tankful

Future "food factory" is visualized by artist. Chlorella and nutrient fluid circulate endlessly in 59 sunlit U-shaped tanks, glass-covered and shallow, each 2,100 feet long and four feet wide. Crop is "harvested" from a part of the flow continuously diverted to processing plant.

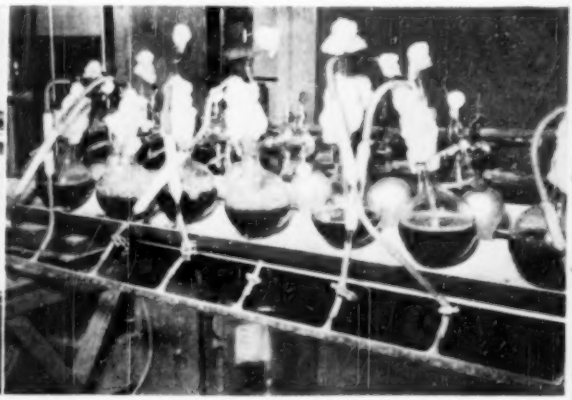
A TINY green, edible fresh-water plant called Chlorella may end world food shortages. Far more efficiently than any present farm crop, it harnesses the sun's energy to make food from carbon dioxide, water, and minerals. Grown in tanks in mass-production "food factories" of the future, it could multiply an acre's yield tenfold. A "pre-pilot" plant, already in operation at Stanford Research Institute in California, shows how the method works.

Individual Chlorella plants, belonging to the one-celled group known as algae, are microscopic globules. They thrive in a mixture of water and minerals "aerated" with carbon dioxide gas. Enormously prolific, they multiply every few hours by dividing in two. Devoid of stalks or other waste, the resulting mass is totally edible.

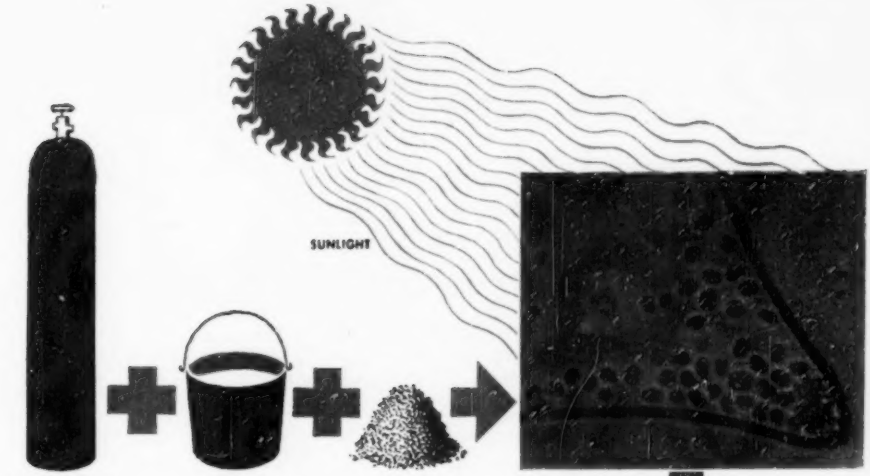
Rivaling the miraculous "shmoo," Chlo-



Stanford pre-pilot plant shows experimenters how to grow Chlorella for food. Centrifuge separates harvest from fluid on small scale. Big plant would do it by flotation process.

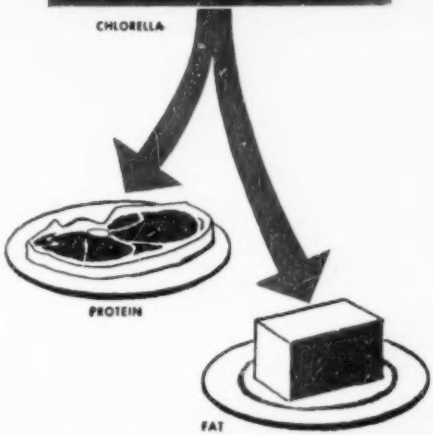


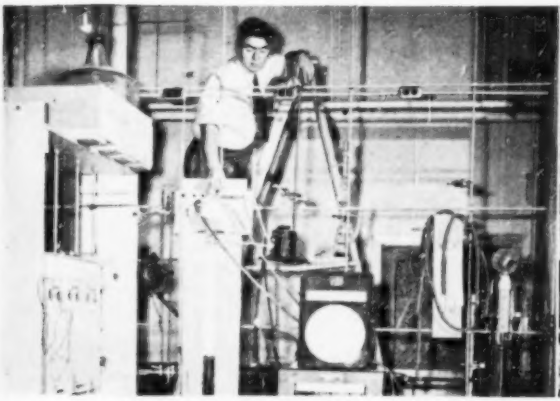
Early experiment was raising Chlorella in flasks lit by incandescent lamps. Tubes supply carbon dioxide. This "batch" culture method now is supplanted by continuous method.



Chlorella turns raw materials into protein or fat as wanted. Plants are tiny globules, magnified 500 times in microscope view (inset). V-shaped line is edge of liquid containing them.

rella obligingly turns itself into whatever is wanted, experimenters find. On a nitrogen-scanty diet, it yields a light-yellow, bland-tasting product rich in fat, which would make a good oleo. More nitrogen gives a deep-green product high in protein content. Tasting like alfalfa when dried, it is to be tried out for feeding chickens and cattle, which would convert it into meat and milk for the table. END





Fluorescent-lit vertical tube, in which Chlorella multiply endlessly for continuous-style culture, is adjusted by technician. Nutrient fluid enters at bottom, and overflow contains "crop."

Rooftop tanks 10 feet long and four feet wide grow Chlorella continuously on biggest scale to date. Photo cell, gauging growth in each tank, regulates liquid supply and overflow.

The frontier was never like this. This latter-day log cabin has two bedrooms, living room, kitchen, and bath. It costs $2,585, complete with garage, breezeway; can be put up in day.

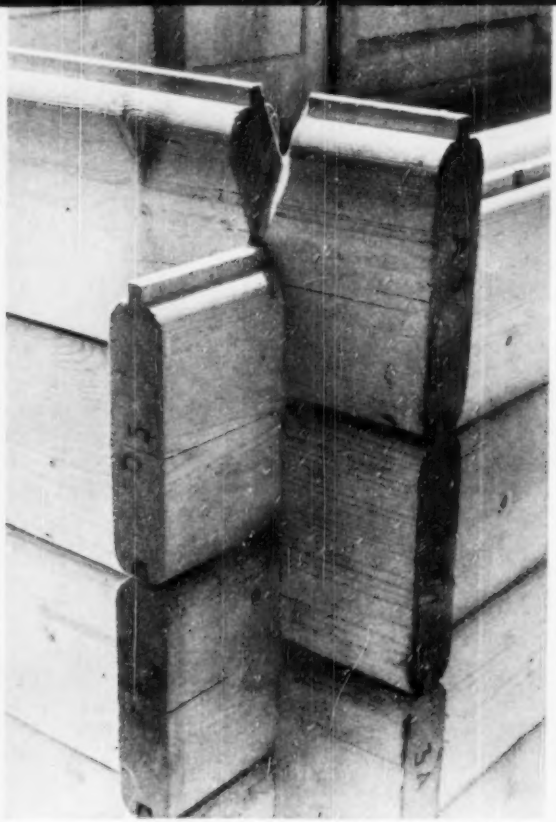
Pre-Cut House Built Like Log Cabin

By Sheldon M. Gallager

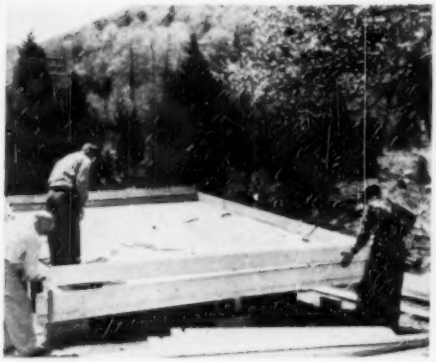
PS photos by W. W. Morris

THE early settlers who hacked their history and homes out of the North Woods wilderness would have to look twice to recognize this streamlined version of the rough-hewn log cabins that kept out winter storms and Indian arrows. For modern-day pioneers have now borrowed this centuries-old construction for use in pre-cut, packaged houses you can buy in a department store and put up yourself over the weekend.

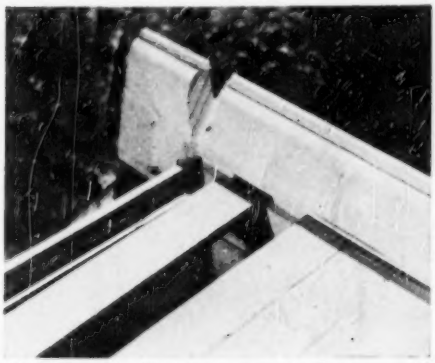
Introduced in this country by the Norge Company, of Norway, and sold by Macy's



Log-cabin construction is shown above. Heavy, 2- by 8-inch wall planks, notched at ends, overlap at corners and lock together. Numbers stamped on plank ends aid correct order of assembly.



Construction begins with floor, laid over joists in conventional way. Wall planks, tongue-and-grooved for tight, weatherproof fit, are then built up, one on top of another, horizontally.



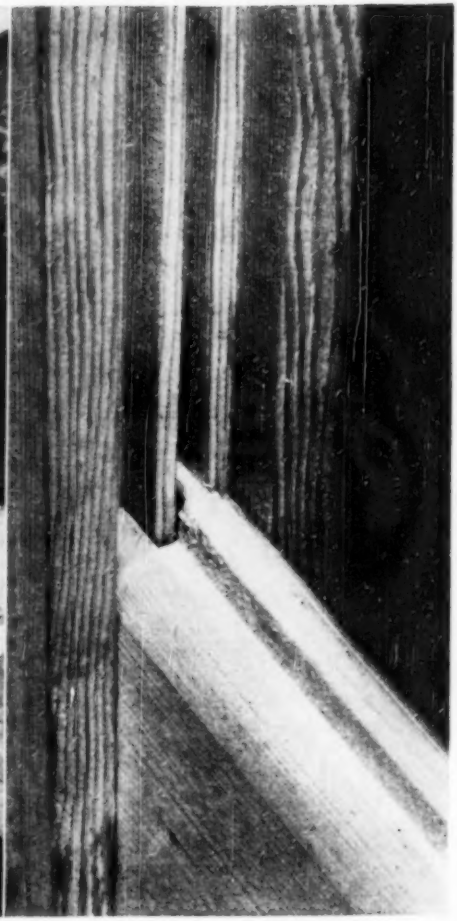
Floor boards fit into groove in bottom wall plank that supports ends, conceals edges. Floor, also tongue-and-grooved, is pre-cut to equal, instead of random, lengths to eliminate sawing.

in New York City, the "log-cabin" houses consist of heavy, two-inch-thick planks that are laid horizontally on top of each other to form both walls and interior partitions. Notched at each end like the logs of old, the planks interlock at the corners of the house to form tight, nailless joints that actually become stronger the longer the house stands. But unlike the logs, the upper edge of each plank has a wide, deep tongue that fits firmly into a matching groove in the bottom of the plank above, providing a strong, weathertight seam.

Each piece in the packaged house is pre-cut to exact length, eliminating all sawing and fitting, and is numbered to show just where it goes. All you have to do is place one piece on top of another and follow the numbers for the correct order. Where doors and windows go, the wall planks are cut to leave the proper openings. You simply take the doors and windows, which come pre-

Partitions, built up of horizontal planks, are formed in same way as walls. Ends of planks are tongued, slide easily into matching dovetail grooves in walls that lock them in place.

Pre-hung door, mounted in heavy frame, comes as single unit, is slid into place between wall ends as soon as wall reaches height of two planks. Interior doors go in at the same time.



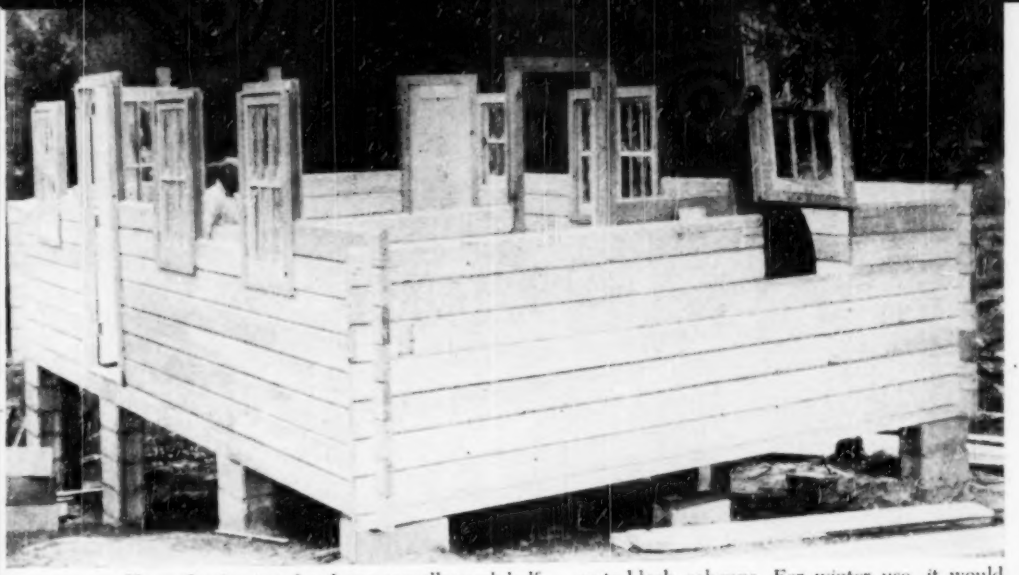
Close-up of door frame, made of solid 4- by 4-inch stock, shows how double tongue-and-groove joint makes strong, weathertight fit with wall. Windows are fitted into walls in the same way.

mounted in heavy frames, and slip them in place as the house progresses.

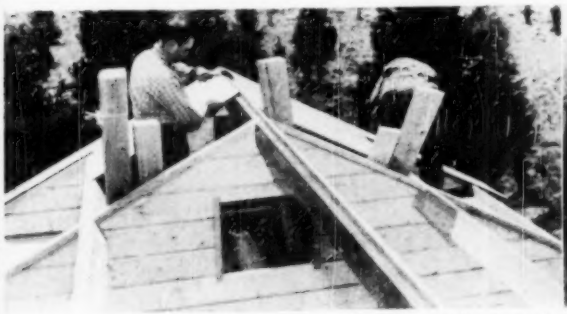
Except in the floor and roof boards, there isn't a nail or bolt in the entire house. The Norwegian-developed construction is called the Tregaard Interlocking System. Said to have withstood wartime bombings in Norway that wrecked ordinary frame houses, it owes its tremendous strength to its own weight and interlocked joints. And because each plank is held tightly to the one below it by the weight of the planks above, any shrinkage in the wood is automatically taken up by the downward pressure of the upper planks—instead of opening up cracks, the house just settles a bit.

Although primarily intended for use in warm climates or as summer cabins, the Norge houses can be winterized for year-round use by installing heating units and insulation. The eight models now available range from a small, one-room cottage for $595 to two- and three-bedroom houses that come, complete with garage and breezeway, for from $2,585 to $2,850.

Unwrap your packaged home on Saturday and, with good weather and friends to help, you should have it up by Sunday.



House begins to take shape as walls reach halfway mark and last window goes in. House shown, intended for summer use, is built on concrete-block columns. For winter use, it would need full foundation, or could be placed directly on ground over radiantly heated concrete slab.



Roof boards are nailed across heavy, horizontal beams that take place of conventional rafters. Boards are butted against narrow ridge on top of upper roof beam to insure even alignment.

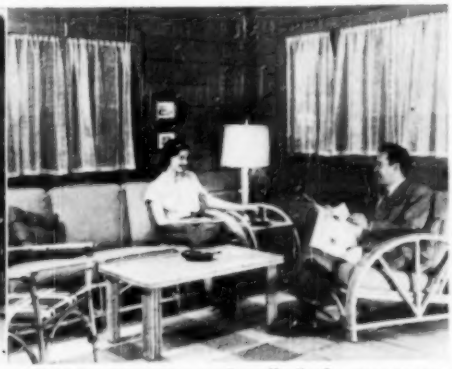
Nearing completion, house looks much like ordinary one except for protruding wall ends. A one-bedroom model, it measures 14 by 23 feet, costs $1,220, was put up by two men in two days.

Unique roof construction is shown in interior view above. Roof boards are supported by three 4- by 6-inch beams that run full length of house and are in turn supported by house's end walls.

Decorative trim, pre-cut to exact size and shape, hides roof edges, is nailed to protruding ends of roof beams. Opening near peak is for ventilation louvers. *[Continued on next page.]*

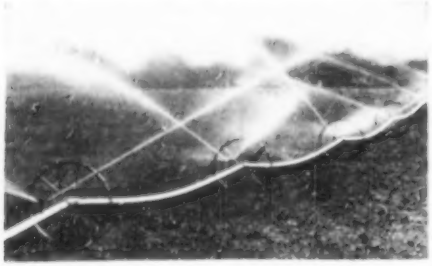
In final step, roof is finished off with conventional asphalt shingles, also supplied with kit. Note shedlike trim nailed over windows to add decorative touch and help keep rain off.

Log-cabin garage goes together like house, has modern, one-piece tilt-up door. This one-car model, 11 by 21 feet, costs $585; a two-car version, 20 by 21 feet, can be had for $900.

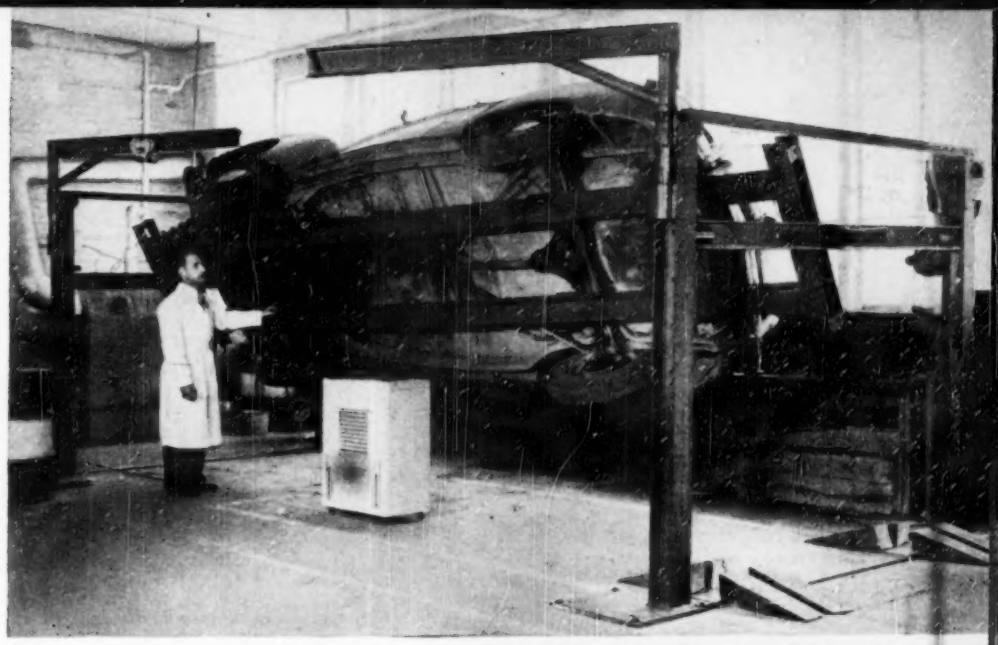


Within house, exposed wall planks give warm, rustic appearance, can be painted, as here, stained, or left natural. For winter use, they can be insulated and covered with wallboard facing.

Irrigation Pipes on Wheels Roll Across Field

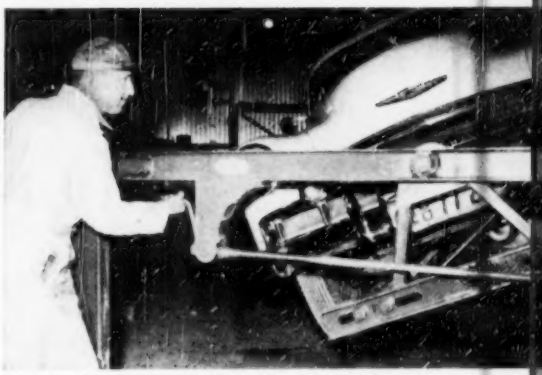


THE long aluminum pipes that irrigate many farms are called "portable" but it usually takes a whole crew to move one. Now special wheels let the farmer do the job alone. The irrigation pipe (left) forms the axle for metal wheels spaced 40 ft. apart. Turning a ratchet drive at the center wheel with a detachable handle makes the whole line move. This way, one man can roll ¼ of a mile of pipe. Stout-Wyss Irrigation, Inc., Portland, Ore., makes the system.



Car Tilted for Easier Servicing

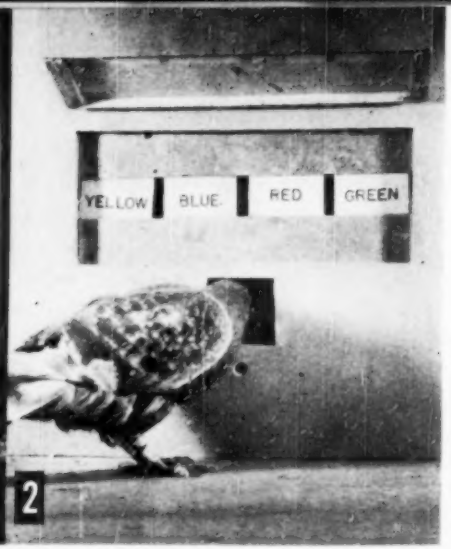
HANDLING major car repairs without getting into a dark and greasy pit is now possible with this automobile "barber's chair," invented by Carlyle Hall of Berkeley, Calif. The car is driven into the Kar-Jig over a short ramp, and the chassis clamped to the two long steel beams. Then ¾-hp. motors spin screw jacks in the corner posts to raise the car to a comfortable working level. Tilting the car brings parts needing service within easy reach. A pair of detachable davits swings heavy parts into place.



Crank tilts car up to 85° either way. It's usually tilted so gas and oil fillers are up. Most batteries retain acid at 70° angle.

Adjustable clamps hook over frame or bumper extensions and lock car against rails. Adjustable strut (in back) takes part of load.

Sitting down on the job means faster work in better light, greater comfort. Many engine, transmission, and rear-end repairs are simplified.



THIS PIGEON would go hungry if he were color blind. Bulbs in box at top cast different colored lights on the bird. In photo No. 1 the pigeon is bathed in yellow light. Being a smart bird, he responds by pecking at the panel with the word "yellow" on it. A feeding trough opens, and in photo No. 2 he collects his reward. Lights change color after each feeding.

Harvard Trains Pigeons To Work for a Living

Photos by Walter Fleischer

WHAT'S the best way to persuade a man to work harder? Can you train a child better by punishing him when he misbehaves or by rewarding him when he's good?

Looking for answers to questions like these, a Harvard scientist has taught pigeons to work for their food, to cooperate with each other, to match colors, to play ping-pong, and to peck out tunes on a piano.

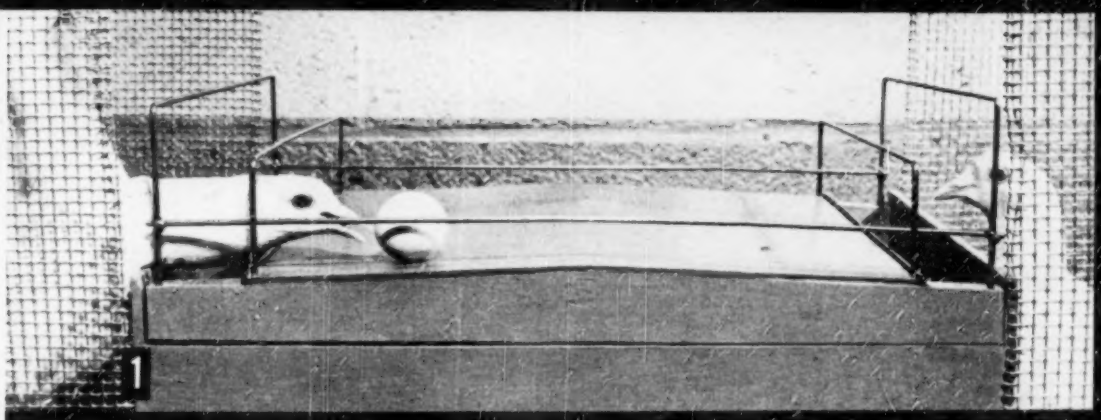
The pigeons learned these tricks while serving as subjects for a series of experiments being made in the Psychological Laboratories of Harvard University, at Cambridge, Mass., to find out why people act the way they do. The experiments were worked out by Dr. B. F. Skinner, professor of psychology, as classroom demonstrations to test his theory that reward is more effective than punishment in getting people—or pigeons—to perform tasks.

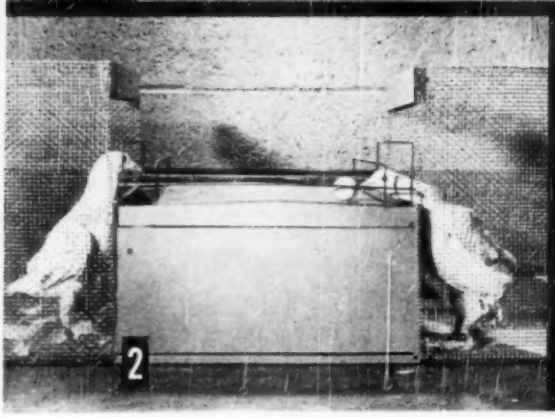
He picked pigeons because they live longer than other laboratory animals—up to 15 years, compared with only two or three for rats—and are less susceptible to disease. Also, pigeons have about the same reaction time as human beings and have good color vision. He now has several dozen at work.

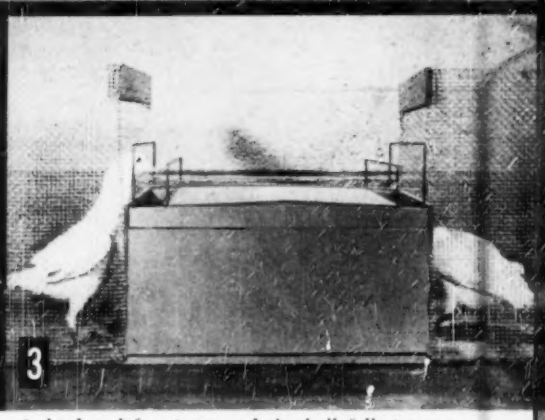
Basically, all of Professor Skinner's experiments involve getting a pigeon to go through some action to receive a reward. The reward in each case is a chance to peck at a bit of food for a couple of seconds. In different experiments, pigeons must learn to cooperate or to compete to win the food.

One of the experiments requires a pigeon to do a certain amount of work to get food. This, explains Professor Skinner, is similar to offering an incentive to a wage-earner. With pigeons, at any rate, a high output can be obtained with very little pay if the schedule of pay-off is right. One pigeon, for example, pecked over 35,000 times in a five-hour period for one third of an ounce of food.

Another demonstration shows that pigeons can be taught to cooperate with each other to get food. (Pictures on page 118.) In an-







PING PONG. PIGEON STYLE. The ball is placed in the middle of a table sloping toward each bird. Player at left in photo No. 1 gets first bat at the ball. Photo No. 2 shows his opponent poised for an expert return. Rallies may go on for three or four returns until, as in photo No. 3, bird at left misses, and the ball falls into a trough in front of him. This opens a feeding station in front of his opponent, who ducks to peck at his prize. Since pigeons are not always good losers, guard rails prevent an excited bird from attacking the victor.

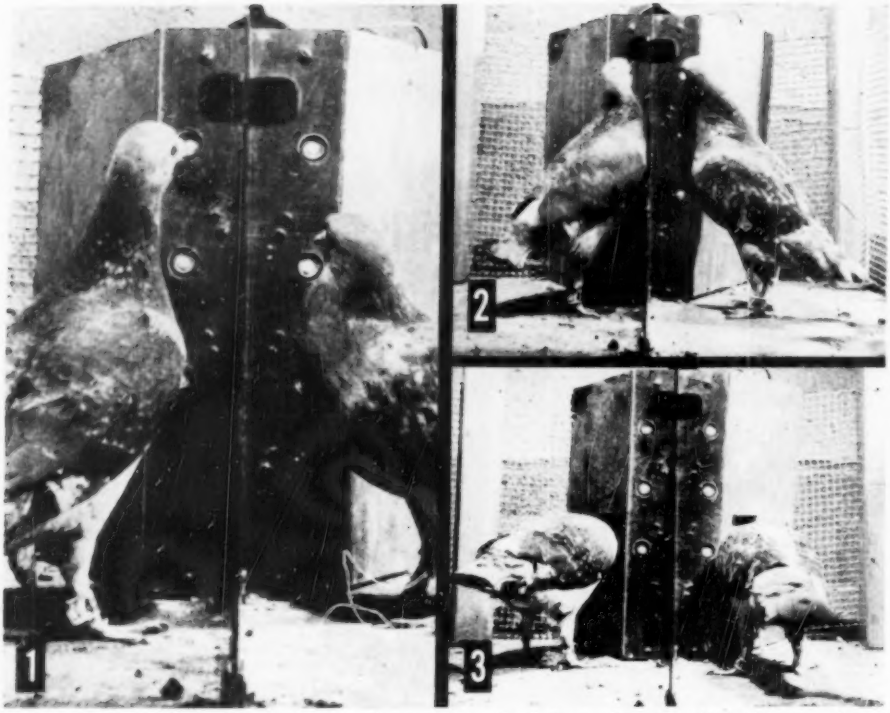
other (pictures on page 116) a small brown and yellow pigeon illustrates both that pigeons can distinguish colors and can act in different ways in response to different colors. The apparatus for this experiment is a semicircular cage with bulbs in a box at the top that throw green, blue, red, or yellow lights on the bird.

Pigeons can also be taught more complicated tasks. One advanced lesson is playing a tune on a piano of seven keys. By rewarding the pigeon when he strikes the keys in a certain sequence, Dr. Skinner and his assistants have taught pigeons to play simple tunes such as "Over the Fence is Out, Boys," and "Take Me Out to the Ball Game."

In still another of Professor Skinner's exhibits, which demonstrates competition, the birds play a modified game of ping-pong. (Pictures on this page.) The court is considerably smaller than regulation size, being about two feet square, and has no net. One pigeon, using his beak, tries to bat the ball past his opponent. Rallies sometimes go to three or four shots but most of the shots are "aces." The winner is rewarded with food after each shot.

Pigeons in some experiments develop an ability to "tell time." If an apparatus will pay off only 10 seconds after a signal, the pigeons learn to wait. They may turn around once or twice, hop from one foot to another, or pick at other parts of the box in order to kill time during the 10 seconds.

Also, like human beings, pigeons are superstitious. They will tend to repeat any action that they may have happened to be doing when food arrived in the past. Some may build up a complicated rigmarole of movements just as a poker player may walk around his chair for luck. The pigeon will



PECKING AT PUSH BUTTONS for their dinner, two pigeons are separated by a pane of glass dividing their cage. After trial and error pecks in photo No. 1, the birds get together, and in photo No. 2 peck at matching buttons at the same time. They've hit the jackpot, opening two feed doors through which they are shown grabbing grain in photo No. 3. To make it harder, the panels can be rigged so that only one of the three matching sets of buttons will open the food doors. Pigeon push-button cooperation takes two to three weeks' training.

continue to go through his routine even though this has no effect on the delivery of food.

Although Professor Skinner usually works with homing pigeons, he has found that park pigeons or the Harvard Yard variety are just as good subjects. One of his best birds, in fact, was a pigeon he captured on a window ledge outside his laboratory. Put to "school," the pigeon was soon playing tunes and batting the ping-pong ball as well as any of the other birds. END

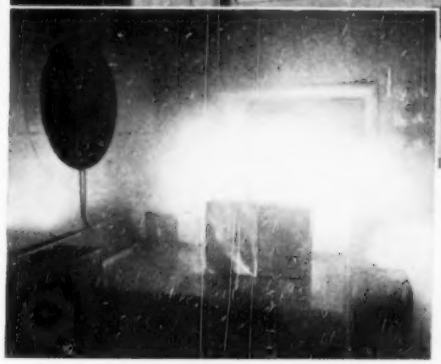
Science Sleuth Finds New Sugarless Sweetener

THE curiosity of a young chemist, who paused during an experiment to trace down a sudden sweet taste in the cigarette he was smoking, has led to the marketing of the first noncaloric sweetening agent that can be used in cooking, baking, and canning without loss of sweetness.

By promptly tasting all the chemicals on his laboratory bench when he noticed the strange sweet taste, Michael Sveda, then a student at the University of Illinois, tracked it to a new compound, called sodium cyclohexyl sulfamate, that he had synthesized.

Now, 13 years later, Abbott Laboratories, of North Chicago, has begun producing the stuff under a patent license. It will soon be sold in drug stores, as effervescent tablets, under the trade name Sucaryl Sodium.

Abbott officials say its chief advantage over saccharin, the only other noncaloric sweetener, is that Sucaryl does not decompose during cooking. Thus it makes possible a more varied menu in diabetic, reducing, and other restricted diets.



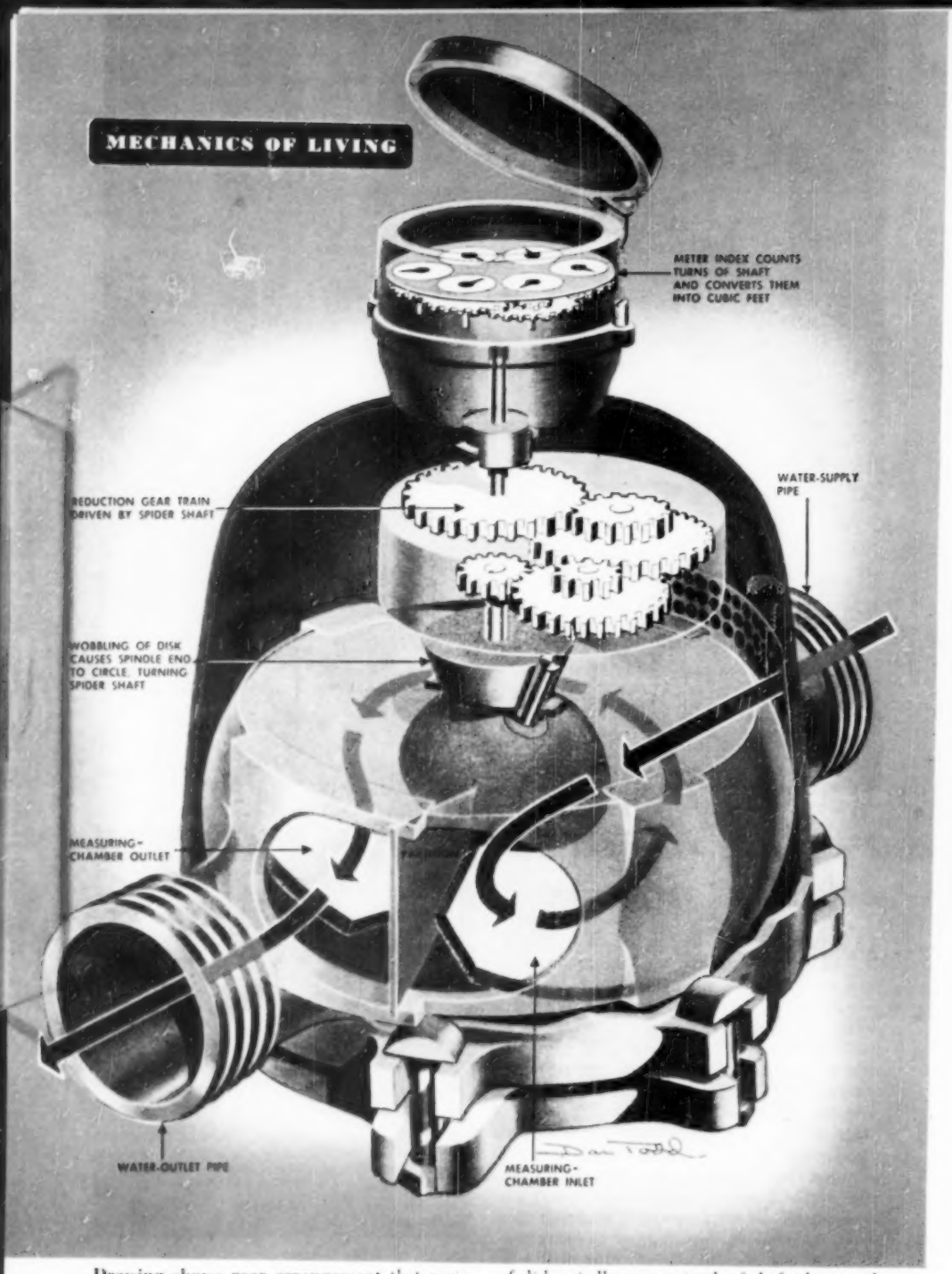
Inside heavy-walled chamber above, packages are ready for simulated flight that will tell how well they withstand plane vibrations, temperature changes, and high-altitude pressures.

Here's one package (left) that will never see the inside of a real plane. Unable to take it, the contents burst into flames; but better packaging will prevent it from happening again.

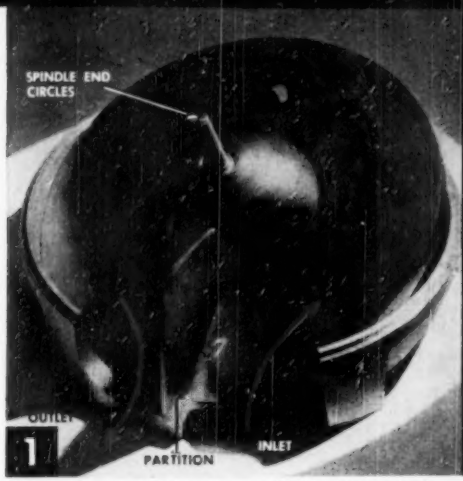
Putting the Heat on Hot Cargoes

WHEN planes carry dangerous packages of acid, explosive, or flammable substances, a sudden jolt or a change in temperature and pressure can result in a tragic accident. Now experts can find out beforehand whether packages can take it: a rough ride in a test chamber simulates actual flight conditions. Temperature and pressure inside the chamber, developed by the Air Materiel Command at Dayton, Ohio, can be varied from sea level to 50,000 feet in three minutes. A vibrating table gives the packages all the jars and jounces they would get in a plane. If they come through all this without breaking, burning, or blowing up, they are considered safe for shipment. If not, better packages are developed that will give their contents kid-glove care.

Tough, flexible bottles of polyethylene plastic, now required for all air shipments of acids as result of tests, take rough beating, as shown in stroboscopic photo above, without breaking.

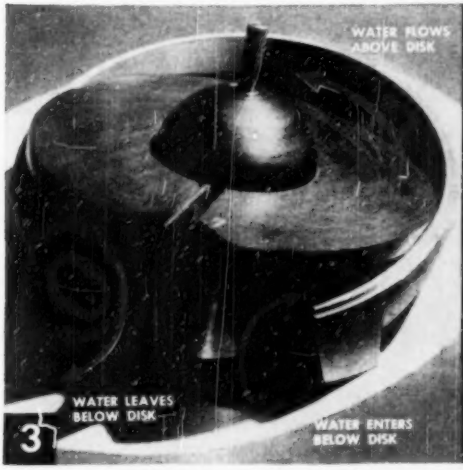


Drawing shows gear arrangement that registers water measurements on dials. The wobbles of disk spindle engage teeth of shaft above and rotate it. Gears transmit information to dials.

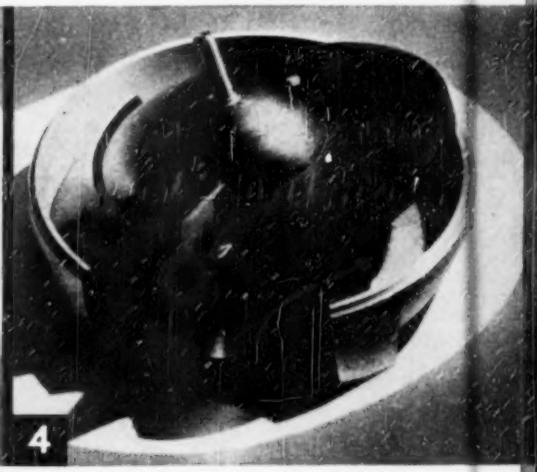


Measuring cycle begins with the disk tilted toward intake. Water flows in and fills the space above the tilted disk. Wall separating intake and outlet fits into a slot in the disk.

Here the pressure of the water above the disk has begun to tilt it away from the intake, allowing more water to enter, this time *below* the disk. Top of spindle has begun rotary motion.



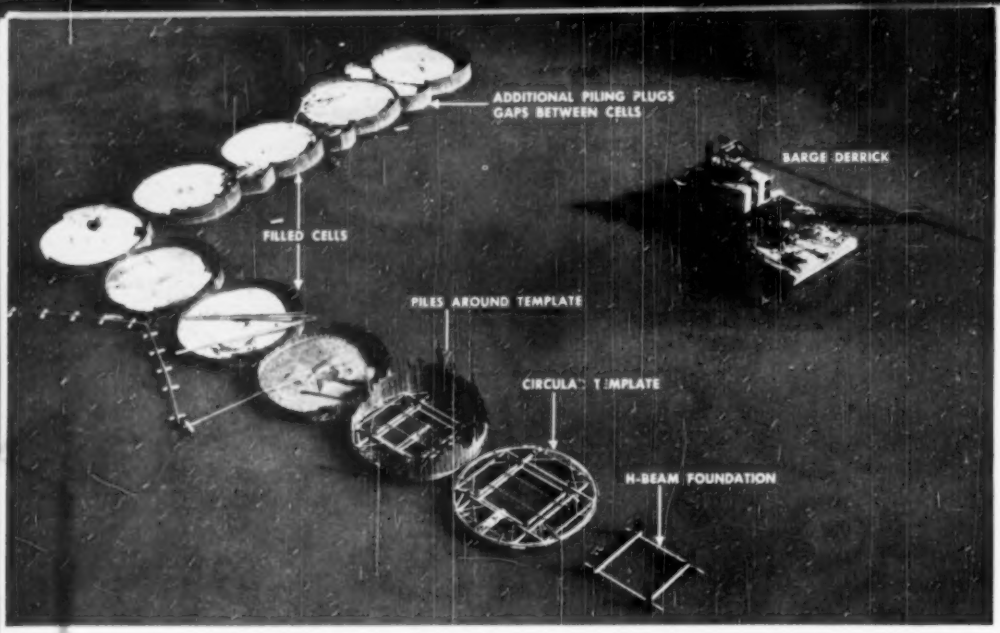
The pressure of the water below the disk continues to force its edge upward at intake. This increase in the tilting motion causes the water above the disk to continue flowing toward outlet.



Here the cycle of the water above the disk is almost complete. Disk has tilted almost enough to allow water to run through outlet. Then more water enters above disk and cycle begins anew.

How Meter Keeps Tabs On the Water You Use

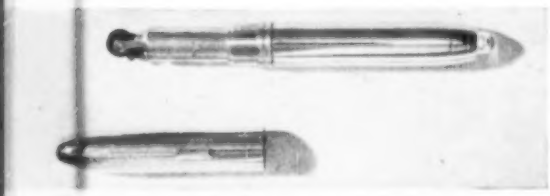
EVERY time you wash your car, water your lawn, or take a shower, this little gadget in your basement works overtime. In your water meter, the wobbings of a hard rubber, toplike disk are translated, through an ingenious gearing arrangement, into cubic feet of water registered on dials. And, because you pay for the water you use, meters help your community save water and avert shortages. The photos and drawing on these pages show you how one of the common types of meters works.



Sand-Filled Cells Make New California Sea Wall

THESE strange-looking, tanklike objects are a new kind of sea wall. Part of a $100,000,000 harbor-expansion project at Long Beach, Calif., the circular cells consist of rings of special interlocking steel piles filled with dredged sand and muck.

Designed to withstand the batterings of tides and waves for centuries, the wall contains 44 of the steel cells, each 62 feet in diameter, forming a breakwater 2,780 feet long. Each cell begins on a foundation of four sunken H beams, as shown in the foreground. Over this is laid a circular template around which the piles are driven. When the piling is complete, the template is removed and the cell filled. The wall was designed by harbor engineer R. R. Shoemaker. The piles were made by Bethlehem Steel.

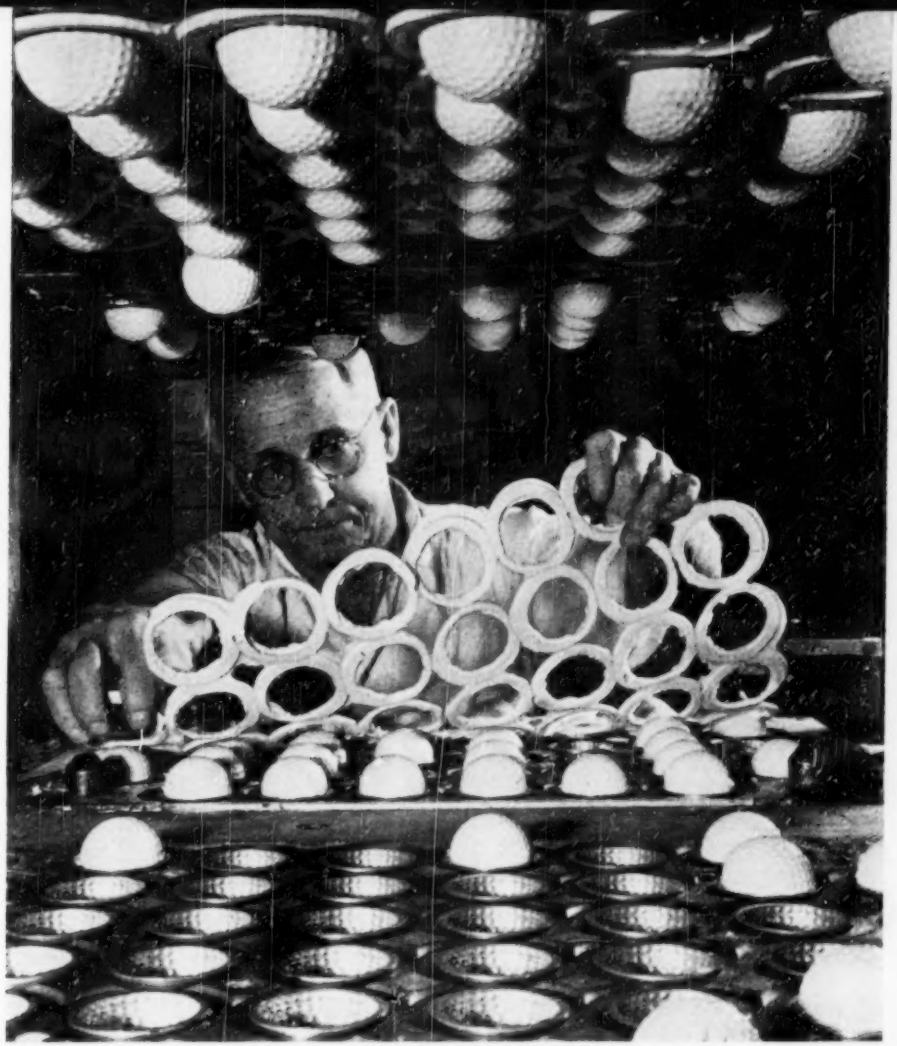


Flashlight Sports Lighter

THIS pen-size Flash-Liter gives you two kinds of light—a miniature flashlight on one end and a cigarette lighter on the other. Twisting a ring in the middle turns the flashlight on or off. Studwell Products Co., of New York City, sells the gadget for $1.

Britain Gets New Jet Fighter

LATEST addition to Britain's Royal Air Force is this sleek, twin-tailed De Havilland jet interceptor, direct descendant of the famed Vampire. Called the Venom, it is powered by a De Havilland Ghost jet engine, the same type that powers the new Comet all-jet air liner (PS, May '50, p. 98). With its new engine developing a static thrust of 5,000 pounds, the Venom has two-thirds more power than the Vampire. This, plus changes in its airframe, gives the Venom a greater speed, faster rate of climb, and higher ceiling than its predecessor.

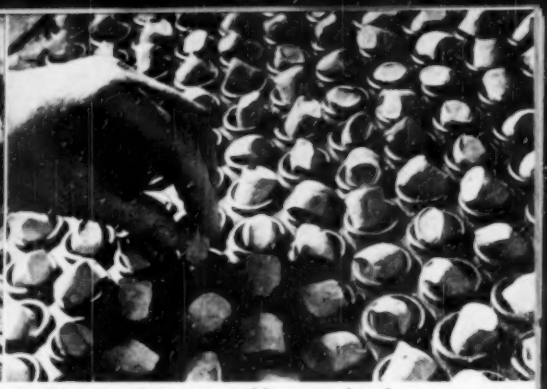


Dimpled cover extends a golf ball's flight. A smooth ball wouldn't travel more than 125 yds.

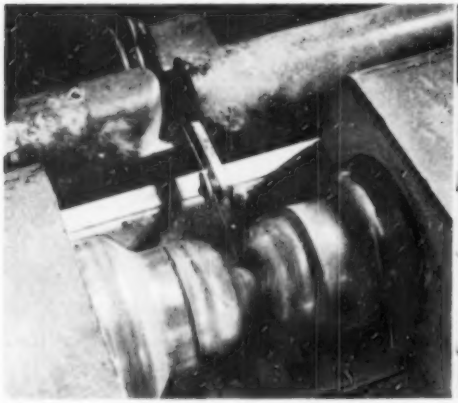
Golf Balls Get Built-In Zip

GOLFERS buy more than 26 million of the little white dimpled pills every year. And to meet the exacting demands of the game's perfectionists, they must be precision built—from core to cover. Even the dimples on the golf ball's cover are the result of extensive aerodynamic tests. A variation of as little as .001 inch in dimple size, it has been found, can materially shorten the flight of a ball. Newest development in golf-ball making are a silicone center instead of an oil center, and electronically controlled winding. Photos on the following pages show some of the 131 operations that go into making golf balls at the Providence, R. I., plant of the U. S. Rubber Co.

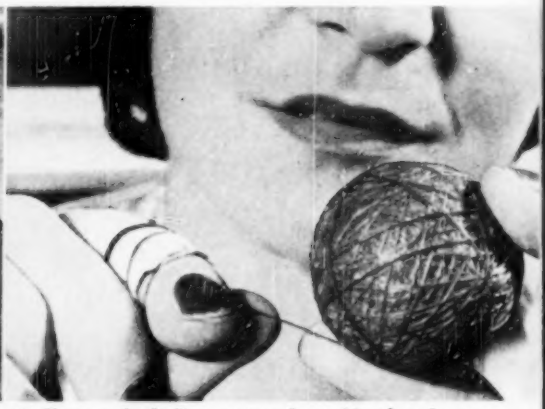
1 **Silicone,** a new substance made from sand that has more bounce than rubber, is used for the centers of "U. S." golf balls. The pea-size centers are stamped out in a press.



2 **Biscuits** of Sumatra rubber are placed in a mold to make halves of jackets for silicone centers. Twenty different materials from all parts of the world go into a good golf ball.

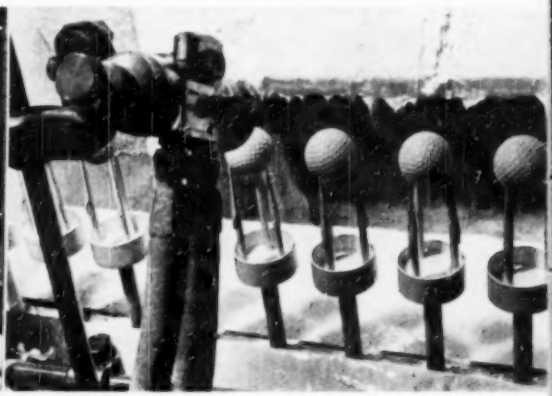


5 **Electronic winder** applies rubber thread to silicone and rubber core. Electronic device, reacting to vibrations of thread in front of photo cell, maintains right tension.

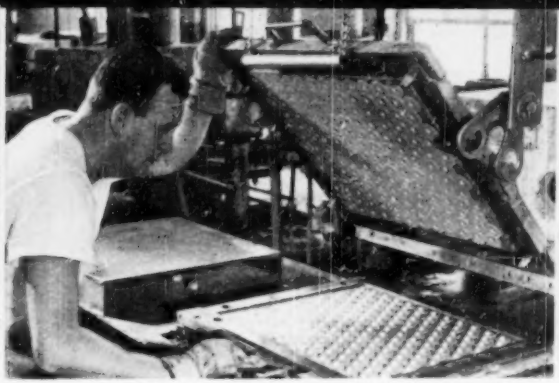


6 **Top-grade ball** contains about 30 yds. of rubber thread stretched to nine times its original length. Energy stored in thread is enough to lift 155-lb. man a distance of 2 ft.

9 **Inspection** of covered balls is one of 100 checks made during their manufacture. A finished ball must not weigh more than 1.62 oz. nor have a diameter larger than 1.68 in.

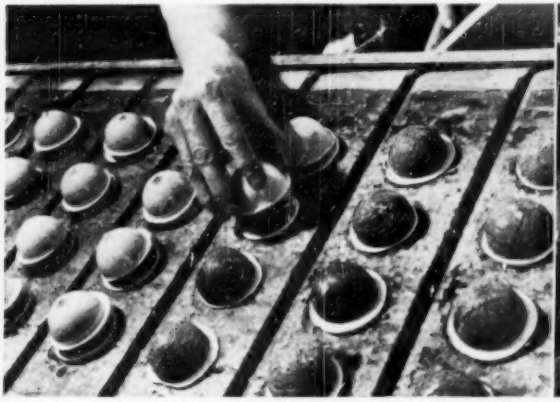


10 **Plastic enamel** gives ball a coating that will stay white, retain its gloss, and be easy to clean. Three coats are applied in special automatic paint-spraying machine.

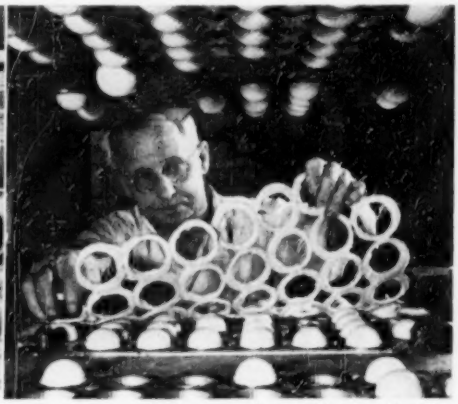


3 Joining the halves. With the tiny silicone centers in place, the two halves of the jackets are next joined to form small rubber balls. Heat and pressure do the trick.

4 Finished cores consisting of the silicone hearts encased in the cushioning jackets, removed from the press, are then trimmed and smoothed before going to the winders.



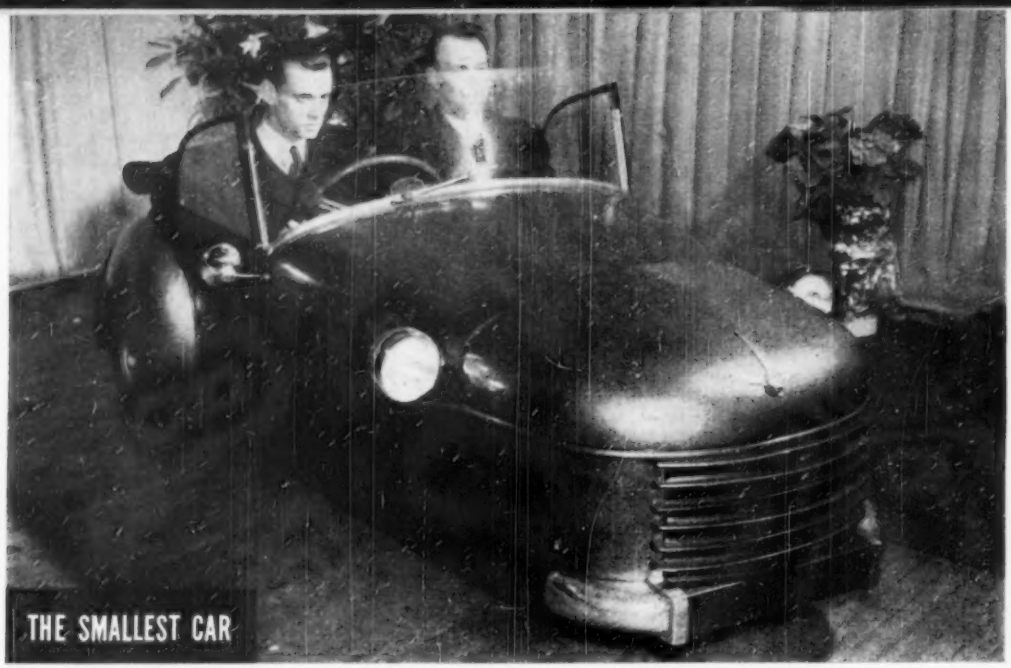
7 Tough outside covers go on next. These are made of balata rubber from Brazil. The first golf balls consisted of a three-piece leather cover stuffed with dampened feathers.



8 Covered balls, complete with the dimples that give them a grip on the air, come from the big molding press, which is first heated, then cooled, to insure proper vulcanization.

11 Each enamel coat is allowed to dry for 18 hrs. before the next coat is applied. Balls are picked off the painting line with tongs and placed on racks for each drying.

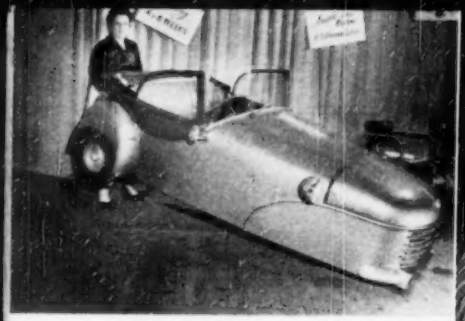
12 Marking. After the trade name "U. S. Royal" has been stamped into the cover of the ball, paint is applied to the imprint. Next stop—the grass on some golf course.



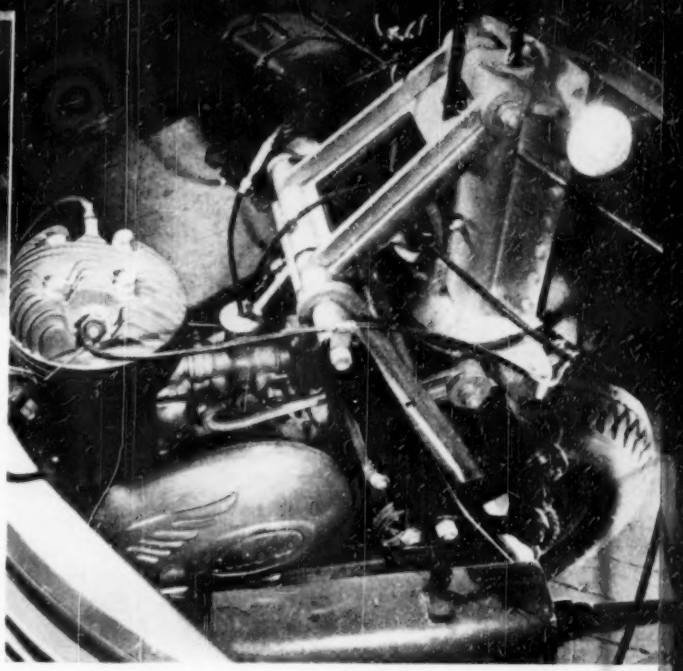
Bond 3-wheeled Minicar, smallest British auto sold in U. S., gets 85-95 miles to gallon of gas.

What's Different about

Biggest car is Daimler convertible—240 in. long, 77 wide, 67 high. Price is more than $13,000.



Rear of 340-lb. machine is lifted easily by a woman; aluminum is extensively used in its construction. Engine drives single front wheel. Rear wheels have separate axles for differential speed in turning. Car cruises at 40-45 m.p.h. Length is 104 in., width 55 in., height 42 in.



Single-cylinder engine drives wheel by chain and sprocket. Mounted on front-wheel support, it has 2 11/32-in. bore, 2 55/64-in. stroke. Like outboard motor, it is lubricated by putting oil in fuel. Car's gas capacity is 2½ gallons. It retails in U. S. at about $950.

British Cars

By Devon Francis

PS Staff Photos

They range from dreamboats to midgets that drink petrol by the teacup, but they all have hand-crafted touches.

IF YOU take a good look around you on U. S. highways these summer days you will see cars that are unmistakably foreign. They're smaller. They're lower. They're shorter and frequently narrower. Some of them are sleeker and faster than the familiar Detroit product. Their styling, engine power, and prices are like nothing we are accustomed to.

And the chances are that socked into their metal, somewhere, is the label "Made in England." For America is undergoing the first real British invasion since the War of 1812. You can buy these cars on the installment plan in showrooms from coast to coast. The British need dollars, and selling their cars here is one way of getting them.

British cars *are* different. They are smaller—and some are bigger—than what we turn out on this side of the Atlantic. Gas—or petrol, as the British call it—is more precious in England. And so the average car made there has a shorter wheelbase and far less poundage, to let them cut engine size and horsepower. Yet when the British set out to make a big car, they dwarf our Cadillacs and Lincolns.

British engine designers differ from their U. S. counterparts in several ways. They like small-bore, long-stroke engines. They have a fondness for overhead valves. They like to run their power plants nearer the "top of the curve" than is U. S. practice, with consequent need for four-speed gearboxes.

The springing on the better British cars is—let's admit it—far and away in advance of ours. The Lagonda perhaps is the best example of specialized weight suspension. The amount of unsprung weight on its rear wheels is fully a third less than it is on American cars. The story was told at the British motor show in New York last April that a man could drive a Lagonda over a

cobblestone street at 60 miles an hour without spilling a drop from a full glass of water placed on the rear seat. That may be stretching the truth, but the car's unique suspension in the rear takes most of the thump out of bumps.

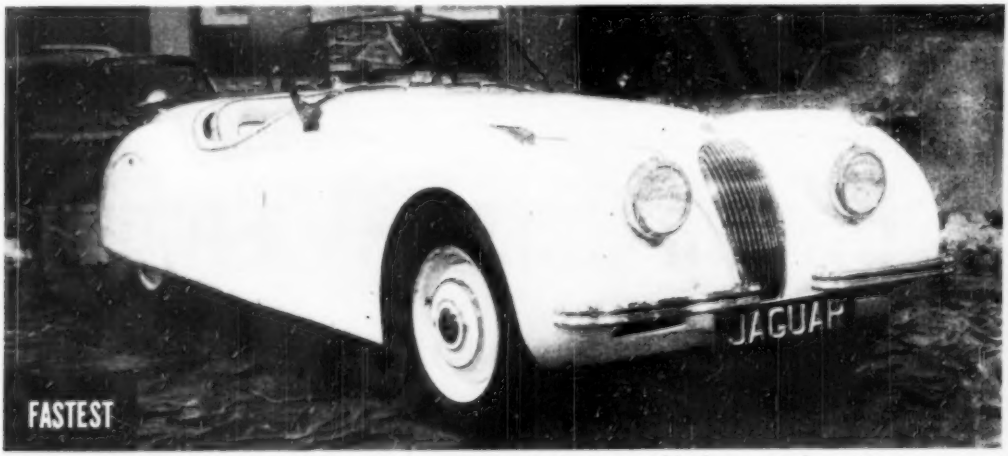
Torsion-bar independent springing both front and rear is no novelty in British cars. There is no such thing in passenger cars on a U. S. assembly line.

In engines, the Jowett Javelin Jupiter is Britain's most radical departure from the conventional. This job has a flat engine of the opposed-cylinder type. It is a tiny power plant by U. S. standards, yet it develops a full 50 hp. at 4,100 r.p.m.

The British are great ones for souping up engines for sports cars. As in this country, a motorist with a yen for something different can buy high-compression heads, special rear-axle gears to get more speed, and even kits to change side-valve engines to overhead-valve jobs.

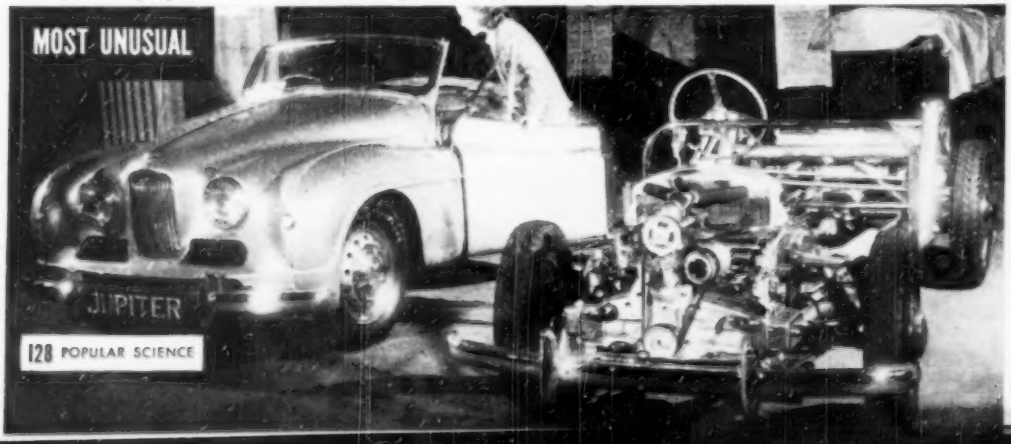
There is a simple reason why the British appear to show more imagination in car design than we do. In fact, there are two. The first is that you can't produce a super-duper car like some of the British jobs and keep the cost down. The second is that U. S. mass production calls for standardization.

In the process of cheering the British effort at motormaking, don't overlook what *we've* got that's different. Patterns of British gearshifting are a nightmare to an American accustomed to a standard shift. And the British offer no automatic transmissions.



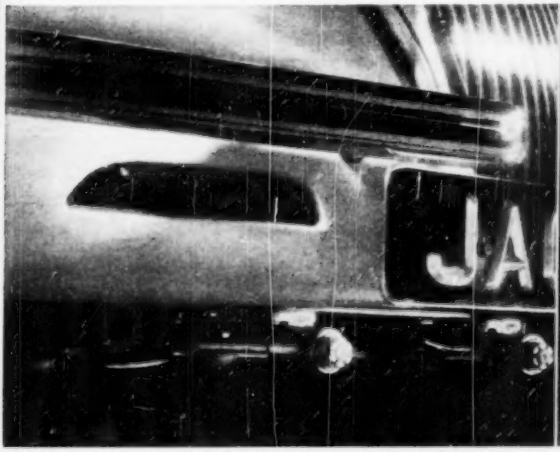
Jaguar is listed as fastest stock car in the world, having been clocked at 132.6 m.p.h. in a test. Priced in New York at $3,945, this Super Sports Convertible has a 6-cyl. engine with a bore of 3 17/64 in. and a stroke of 4 11/64. At 5,200 r.p.m., it develops 160 hp.

One of the best-looking British cars is Jupiter convertible, also with an 8-to-1 compression ratio and a top speed of more than 95 m.p.h. Four-cylinder flat engine is forward of front axle, radiator behind. Wheelbase is 93 in., length 163 in. Price: $2,548, including heater.

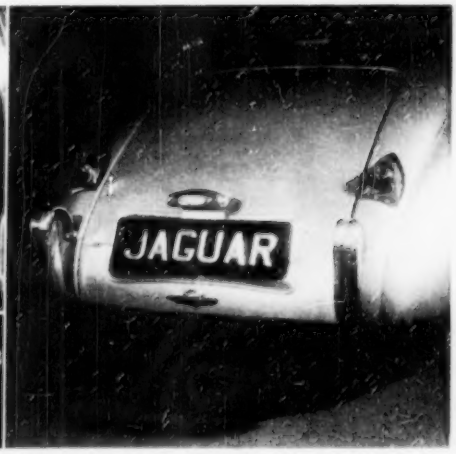


SPORTIEST

Allard competition two-seater can be built from kit, uses many Ford parts. Chassis will take various souped-up engines. Cost complete is $3,245; without an engine, $2,620.



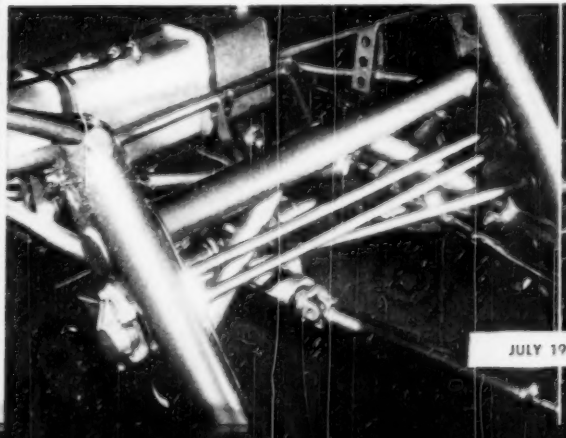
Jaguar's high speed calls for slotted fender apron in front to admit air for cooling brakes. Wheelbase is 102 in. and over-all length, 174.

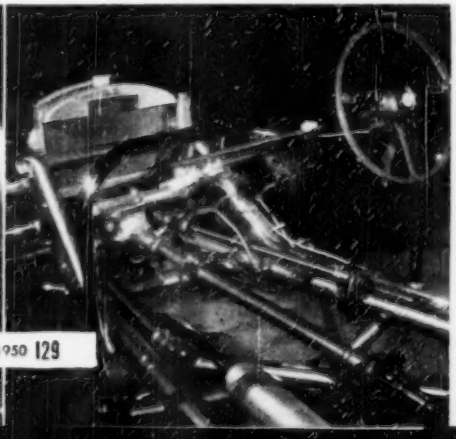


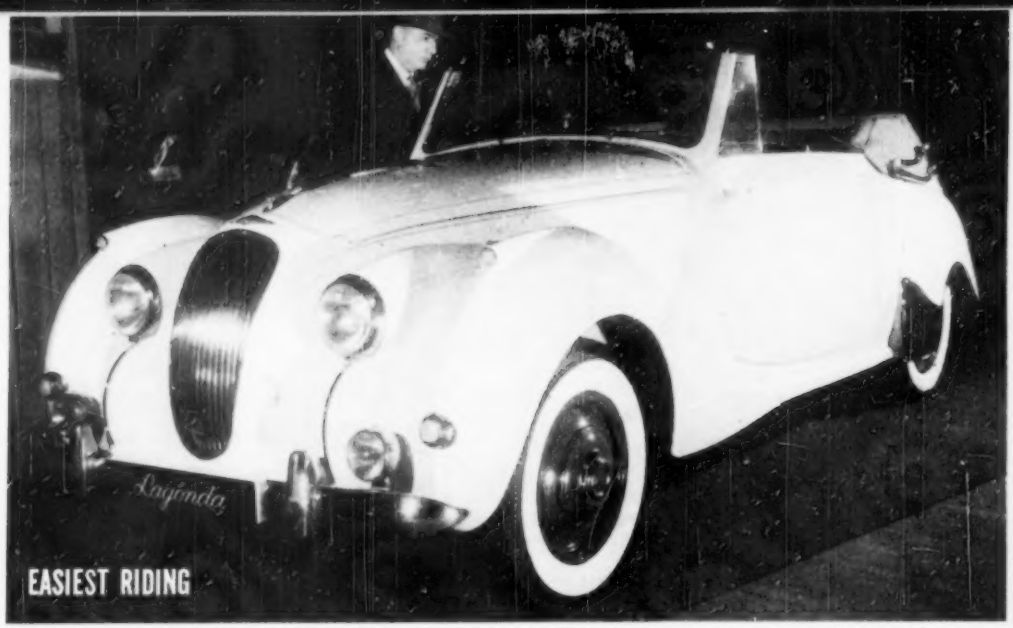
In interest of clean lines, car's protection against rear collision is limited. Compression ratio is high by U. S. standards: 8-to-1.

Frame is welded tubing. Two small transverse rods under cross member are torsion bars for rear springing. Third bar is a stabilizer.

Between radiator and dash, Jupiter has only structural members, transmission, shaft, and steering column. *[Please turn the page]*



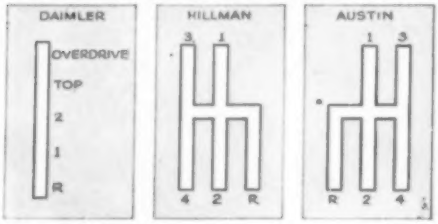




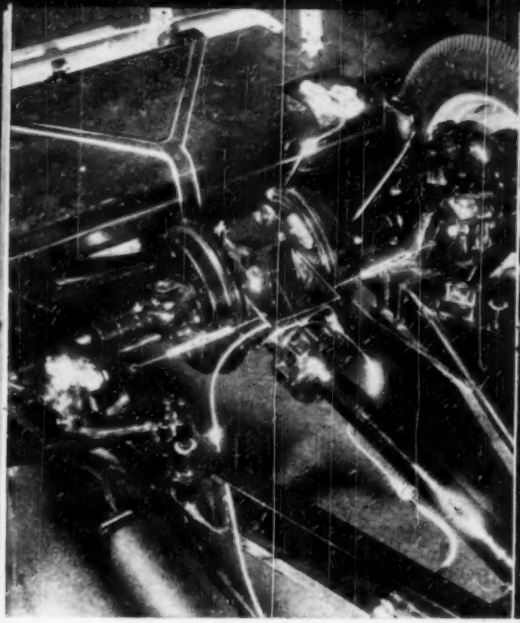
Independent rear-wheel suspension, low unsprung weight, give Lagonda exceptional riding qualities. Drive shafts protruding from differential (right) have two universals each and splined couplings that permit change in shaft length as wheels rise and fall over road bumps.

Bristol sedan, made by same company that produced Brabazon, world's biggest passenger plane, has push-button doors; interior locking for hood, luggage compartment, spare wheel, and gas-filler door; rubber-backed bumpers; and thermostatically controlled radiator shutters.

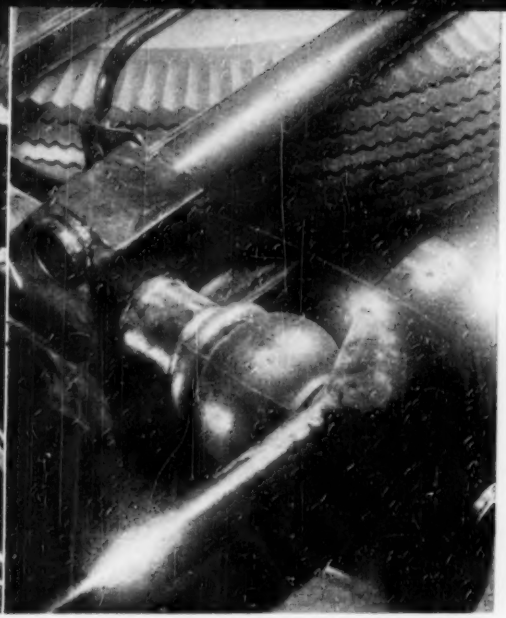
Daimler's up-and-down shift with fluid clutch is shown at left below. Hillman Minx, center, shifts directly opposite from Austin, right.



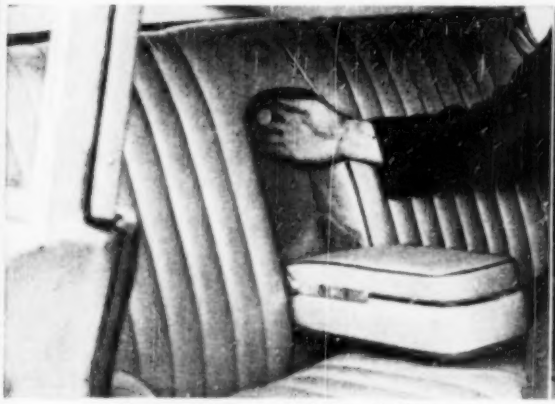
Built-in jacking system on Austin consists of threaded pedestal that is cranked down through outer car frame. Greatest advantage is rigidity of support. British last year produced 630,665 cars, trucks, and buses, of which more than half were exported. Gimmicks like one at right are selling points in U. S. market.



Wheels are mounted on wishbones, with torsion-bar springing. Putting brake drums inboard on chassis lessens the unsprung weight.



Bumpers, made of rolled steel for strength, act against foot-long rubber-core shock absorbers. Convertible delivers in New York for $6,950.



To open luggage lid, drop folding arm rest in rear seat and pull this control. Body is made of aluminum-alloy sheet on steel framework.

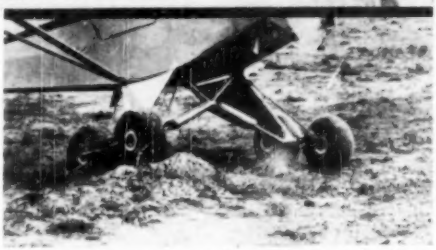
Another hidden button releases locked door over gas-filler cap. Available here only by special import, car sells in England for $5,400.

Locating spare wheel in locked compartment with its own door underneath luggage bin is common British practice. Here's Jupiter's spare.

This import is pedal-propelled toy with real headlights. Priced at $149, it was most expensive vehicle per pound in recent British-car show.

Lightplane Leaps Off Ground

THIS new Piper Super Cub can be off the ground in five lengths of its own fuselage and land in as little as 75 feet. Above, it clears a 20-foot obstacle from a standing start 200 feet away. The two-place, 108-hp. plane can climb at better than 1,000 feet a minute and cruise at 105 m.p.h. Designed primarily for crop dusting and spraying, the new Cub can throttle down to 33 m.p.h., and carry its own weight in chemicals.



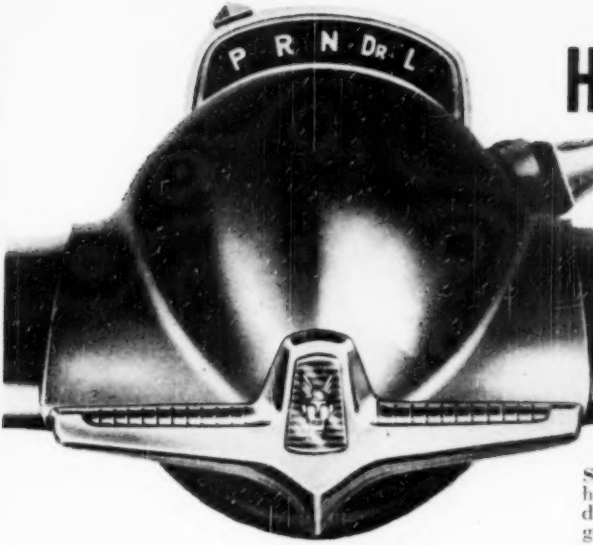
New tandem gear enables plane to land on muddy fields, climb over rough, rocky ground.

New Plastic Outdoes Rubber

THE four middle strips above are samples of a new flexible plastic made in varying degrees of hardness and elasticity to bridge the gap between brittle rubber (strip at far left) and soft rubber (far right). A thermosetting plastic, Enrup is abrasive- and chemical-resistant. Used for gears and other machinery parts, it will outlast metal in many such applications. It was developed by the U. S. Rubber Co.

Porthole Simplifies Storage

ARMY engineers devised this "porthole" to check on humidity and temperature inside packages of "moth-balled" equipment. The plastic window allows warehouse workers to see a thermometer and humidity gauge mounted inside a package without breaking the moistureproof seal. When humidity rises about a critical 20-percent level, the window is unscrewed, and a drying agent is added to prevent corrosion.



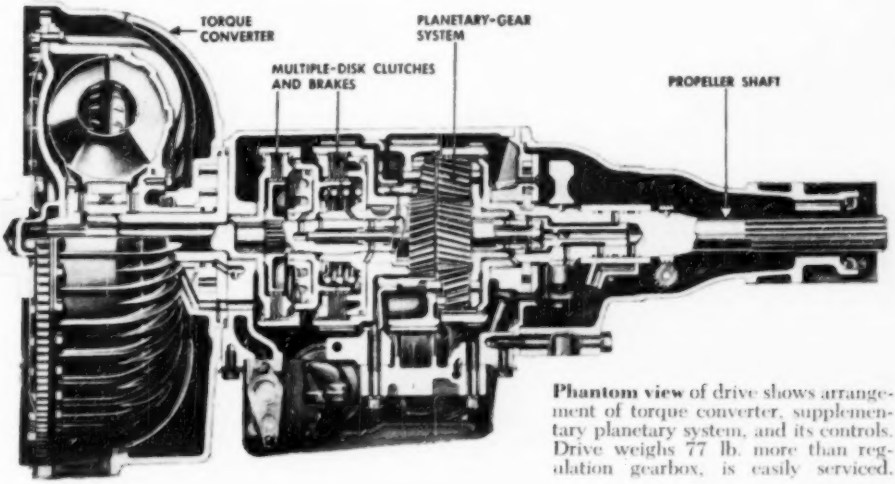
Here's that New Ford Transmission

Shift quadrant on new Ford-Mercury drive has unusual selector sequence. To avoid accidental over-travel, lever must be pulled up in going to reverse or low from neutral or drive.

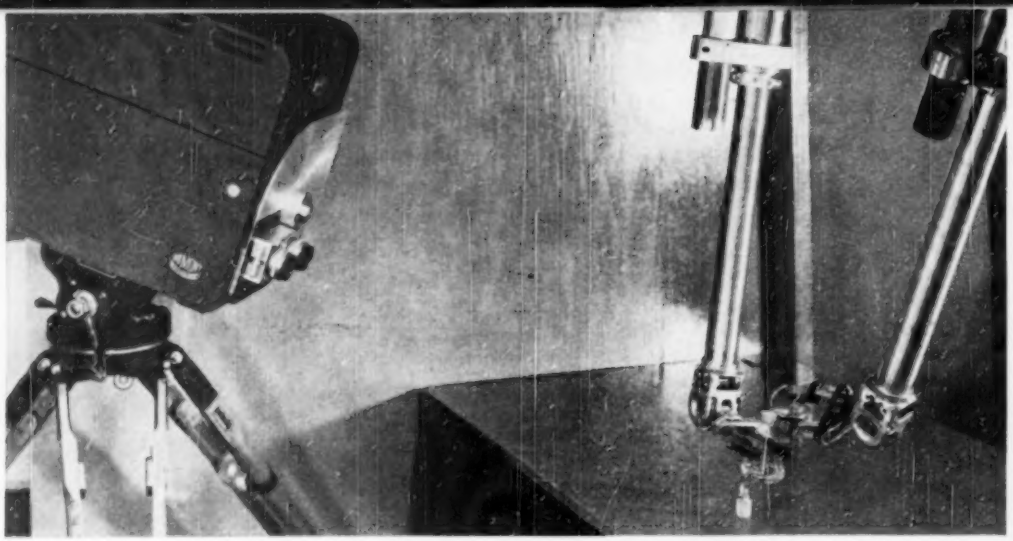
FORD announced that new automatic drive last month. Forecast in POPULAR SCIENCE's review of the new transmissions (April '50, p. 98), it's an optional, extra-cost drive that's also available on the Mercury

Unlike the drive in a Dynaflow Buick, which is essentially just a torque converter, or in the Chrysler, which has no torque converter, Ford uses a torque converter coupled to an automatic planetary gearbox. In this it resembles Packard and Studebaker. It differs, though, in that the torque converter, which becomes a low-slip fluid coupling at speed, *is always* in the power train. It has no lock-out feature. Ford engineers say that, by eliminating lock-out, they can use a more efficient converter and rear-axle ratio, and hence save on gas. Frequent shifts between direct and converter drive are eliminated.

The transmission has low, intermediate, high, and reverse gears in its automatic planetary gearbox. With the selector in "Drive," you start up in second plus torque converter. There's down-hill engine braking, and you can rock it in snow or mud.



Phantom view of drive shows arrangement of torque converter, supplementary planetary system, and its controls. Drive weighs 77 lb. more than regulation gearbox, is easily serviced.



Two-eyed TV camera sends stereoscopic view as mechanical hands open radioactive material.

Three-Dimensional TV Gets First Job in Atom Lab

YOU could sit in New York and watch yourself open a can of beer in Chicago with the new television-eyed mechanical hands at Argonne National Laboratories. Actually, Argonne scientists don't get as far off as New York, and they don't open beer cans—they watch their mechanical hands work on deadly radioactive materials.

Three-dimensional television, used here for the first time, lets the scientists see at a distance with all the fully rounded depth caught by human eyes. Mechanical hands let them do at a distance almost anything human hands can do. One type of mechanical hand is electrically controlled, so experiments can be performed at any separation—from another building, or even another city.

But most often, the scientist sits on one side of a thick concrete wall, with the hot stuff, experimental equipment, and stereo TV camera on the other side. He watches the TV screen and works the mechanical hands. The third dimension helps him spot tools and equipment more easily and accurately—it is very difficult, for example, to pour liquid from one container to another without a perception of depth.

The stereoscopic method is similar to one used in some three-dimensional movies. The television camera has two lenses, set side by side about as far apart as human eyes. The lenses focus slightly different images—one for each eye—on a single TV camera tube.

A standard table-model receiver then shows the two pictures side by side. In front of each picture is a polarizing filter, one polarizing horizontally, the other vertically. The operator wears polarizing spectacles with one lens polarizing horizontally, the other vertically. Thus his left eye can see the "left" picture because the "left" picture filter polarizes the same way as the left eye's lens. His left eye cannot see the "right" picture because its filter polarizes in the other direction, and it therefore appears black. In the same way, the operator's right eye sees the "right" picture but can't see the "left." Prisms on the operator's spectacles shift the two side-by-side pictures so that they fuse into one three-dimensional image.

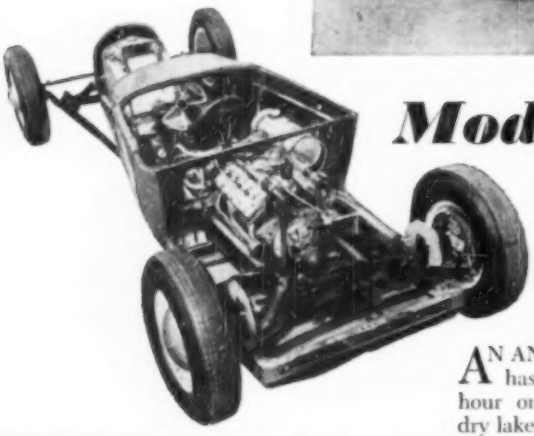
Two images on screen—one from each lens—are fused into single stereoscopic picture by operator's spectacles. This viewing setup could be used for entertainment TV in three dimensions.

A different viewing set-up has two receivers, one for the "right" image and one for the "left." They are mounted at right angles to each other, with a polarizing filter over each screen, and with a semitransparent mirror at a 45° angle between the two sets. The mirror both reflects and transmits light, so that the two pictures overlap. This eliminates the need for the prisms (but not for polarizing spectacles), and makes it easier for several people to watch at once.

Can TV entertainment broadcasts be given a third dimension the same way? Yes, say engineers of Allen B. DuMont Laboratories, which supplied Argonne's video equipment. It would require no important changes in present transmitters or receivers—just twin lenses on the cameras, filters on the viewing screens, and the special polarizing-prism spectacles for the audience. Picture detail, however, would be reduced. DuMont has no plans for stereo telecasts now, but both it and Argonne point out that the system might find many industrial and military uses aside from handling hot atoms. END

Different three-dimensional viewer uses two receivers and semitransparent mirror to make pictures overlap. It simplifies viewing spectacles, permits more people to watch at once.

Builder of this hot rod, above, hits it up, right. Dog clutch couples rear engine, below, to rear end by short drive shaft, eliminating the transmission.

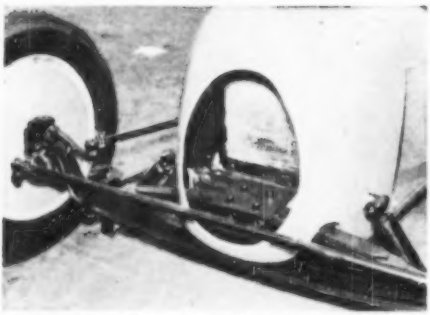


Model T Comes to Life as Hot Rod

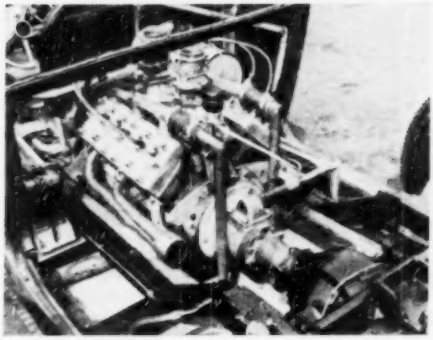
AN ANCIENT chassis in streamlined dress has been clocked at 134.73 miles an hour on Southern California's El Mirage dry lake. The power in this hot rod, built by Ray Brown of Los Angeles, is moderate—a 60 hp. Ford V-8 engine that is 12 years old. The chassis, lifted from a 23-year-old Model T, got a thorough reworking.

The hot-rod fraternity, to whom speed is a fetish, consider the Brown homemade roadster one of the most original designs yet to sizzle across the alkali. Chief among its innovations is an engine mounted in the rear and cooled by a front-mounted radiator.

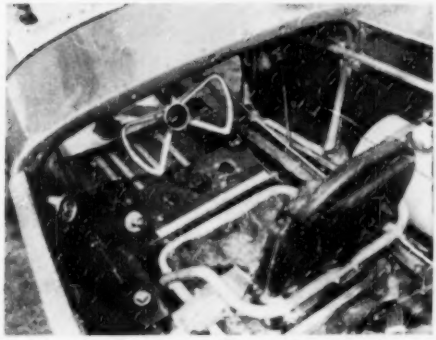
Model-T rails form the frame. Tubing replaces both the front and rear crossmembers, strengthening and lowering the chassis. The tie rod crosses in front of the oval air intake in the nose. A Franklin ball-bearing steering unit has been converted to a center-mounted



Air scoop cools engine. Four thin-wall aluminum tubes route water between radiator and engine. Engine jacket has four water intakes.



Engine is bored .1 in. oversize to 2.7 in. and stroke lengthened .2 in. to 3.4 in. Pistons are aluminum. Compression ratio is 8.75-to-1.

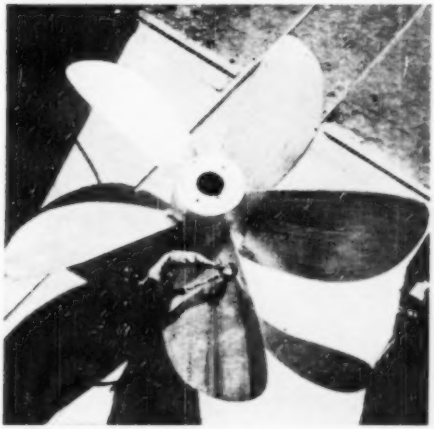


Controls are foot accelerator, hand brake on left, hand clutch on right. Rear-end gear ratio is 3.78-to-1. Highest engine r.p.m. is 6,800.

inverted type. Brakes, on the rear wheels only, are late-model Ford hydraulics.

For speed runs, an aluminum shroud seals the engine off from the cockpit. A canvas tarpaulin is stretched taut over the cockpit to reduce air turbulence at high speed. The car weighs 1,500 pounds. It is painted a blazing red and white.

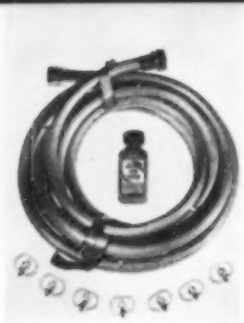
Tanker Prop Has Five Blades



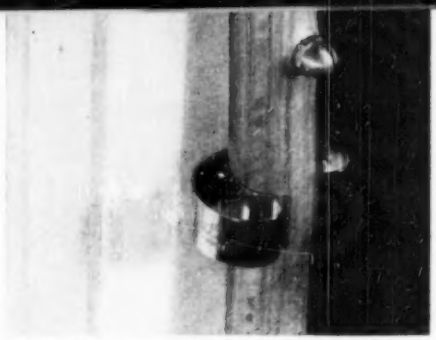
WHEN a conventional propeller set up severe vibrations in a big new tanker, the S.S. *R. G. Follis*, designers came up with the petal-like screw pictured above. Weighing 18 tons, the manganese-bronze casting is 18 feet in diameter. A 5,000-hp. steam turbine provides the power to spin it. Shipbuilders term the five-bladed propeller a revolutionary development for large single-screw vessels; previous installations have been on the wing shafts of quadruple-screw, high-performance naval craft. With its new prop, the *Follis* has no critical vibration, and goes faster at a lower shaft speed.

B-36 Pods Hold Spare Engines

THESE metal growths under the wings of a B-36 fuselage are nacelles hung from the bomb bays for carrying spare engines to bases where they are needed. The bomber's builder, Consolidated Vultee, says each of the two pods will accommodate two nacelles and engines, totaling four big radial engines between them. The containers are attached to streamlined beams suspended from the bomb racks in the forward section of a bomb bay. Each is 32 feet long and about eight feet in diameter at its widest point. Combined weight of the two containers, with spare engines loaded, is 25,000 pounds.



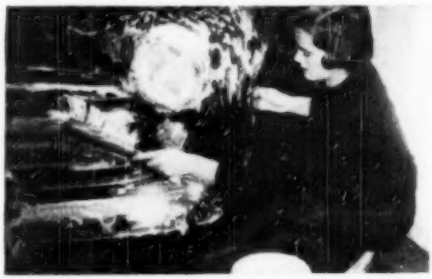
Auto shower consists of 17½-foot plastic hose fitted with 7 tiny brass nozzles. Kit also includes 7 clips that hold hose to door frame and bottle of special detergent shampoo that is good for about 5 washings.



Metal clips, screwed to door frame, hold hose to sides and top of garage. Nozzles point slightly outward to prevent spraying into garage.

New Auto Shower Sprays Car Clean

YOU can now wash your car in your own garage just the way big auto laundries do. This home auto shower is simply a plastic hose, fitted with tiny nozzles, that fastens to the door frame of a garage. In action, it sprays a car from all sides at once. The car is first sudsed with a detergent, then driven slowly back and forth through the spray to rinse it clean. Time: 15 min. to install, six to wash. Maitland Products, Port Washington, N. Y., sells the kit for $6.95.



Soft brush or rag is used to suds all surfaces of the car with a special detergent, mixed one teaspoonful to a pail of hard or soft water.

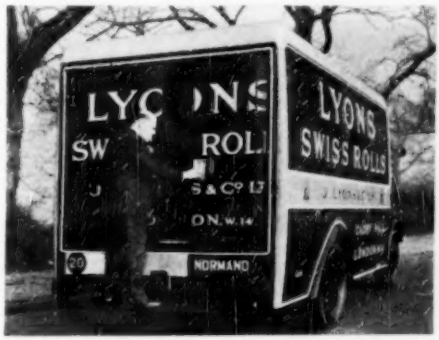
Experimental model above, attached to garden hose, shows how sprayer works. Unit on the market has seven nozzles that cover top and sides of car. Maker says it doesn't waste water.

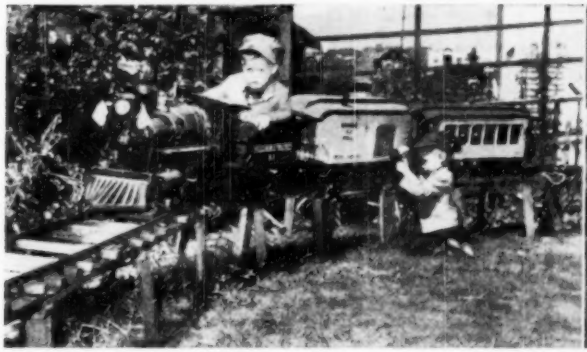
Speedboat "Flies" Like Plane

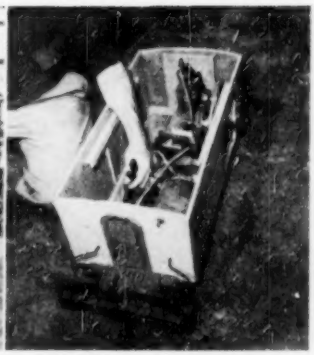
THIS hydrofoil speedboat can do everything an airplane can do but fly—and it can almost do that. Three underwater fins, shaped like airfoils, enable it to climb right out of the water, riding on the fins instead of the hull. The fins, which can be tilted up or down, are controlled by an airplane-type stick. Moving the stick forward or back operates the bow fin, causing the boat to climb or dive. Sideways motion controls the stern fins, making the boat bank to either side. Pedals operate the outboard motor as a rudder. The novel boat was built by Allyn Hazard, of Albuquerque, N. M.

Truck Doors Roll Open

THE British-made doors on the truck at right work like an old-fashioned roll-top desk. Made of narrow aluminum slats hinged together, the flexible doors roll along tracks on small wheels. The tracks curve inward at each corner of the truck's rear, carrying the doors back into the walls. Developed by Normand, Ltd., of London, the new doors are said to give truckers greater freedom of movement while eliminating the hazards of ordinary doors that often stick out into the street or sidewalk when open.

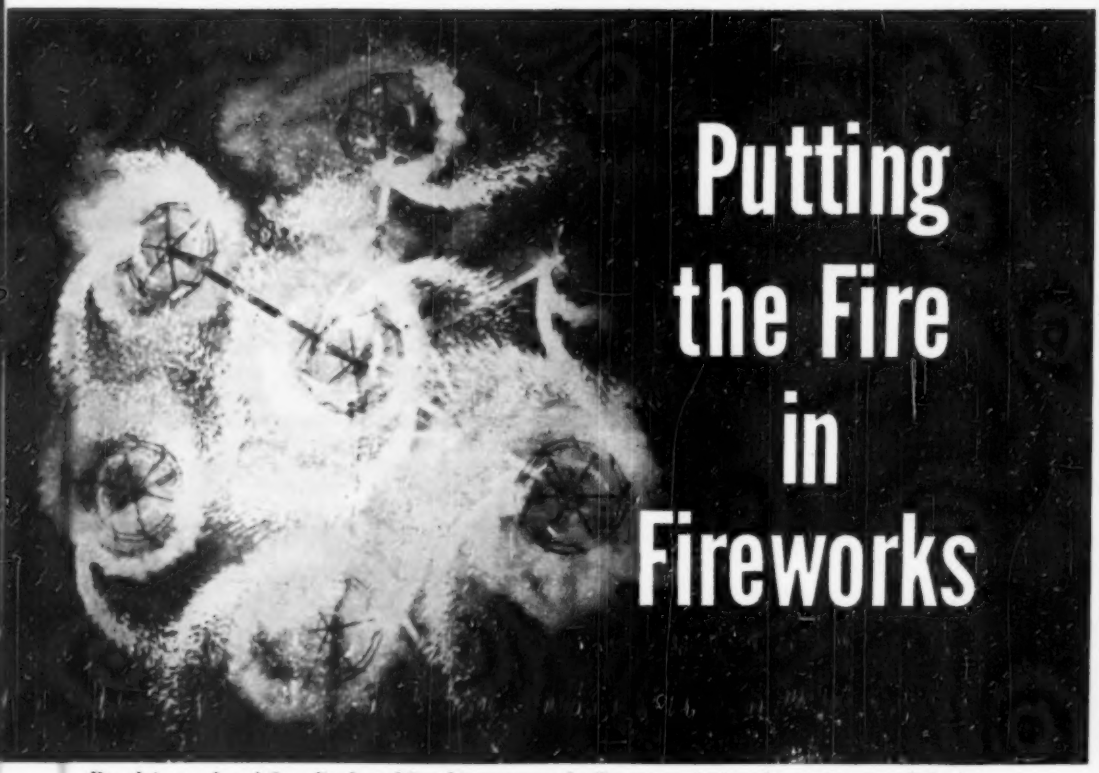






Model Railroad Hauls Kids

JUNIOR trainmen Paul and Barney Simonson ride this authentic reproduction of a historic Virginia and Truckee train around a 150-foot track in their Oakland, Calif., back yard. It was built by their grandfather, home-movie hobbyist Ray Maker (PS, June '50, p. 156). Two small electric motors, one in the 40-inch-long locomotive and the other in the mail car (right above), give it a top speed of 7 m.p.h. Another motor, in the mail car, drives a compressor to blow the whistle. A fourth motor, in the engine, operates a bellows to puff out smoke made by burning a mixture of oily waste and tar.



Putting the Fire in Fireworks

Revolving colored-fire displays like this one gradually are replacing firecrackers on July 4.

A salute to the men and machines that work all year to give you a bang-up Fourth of July

By Devon Francis

PS photos by Hubert Luckett

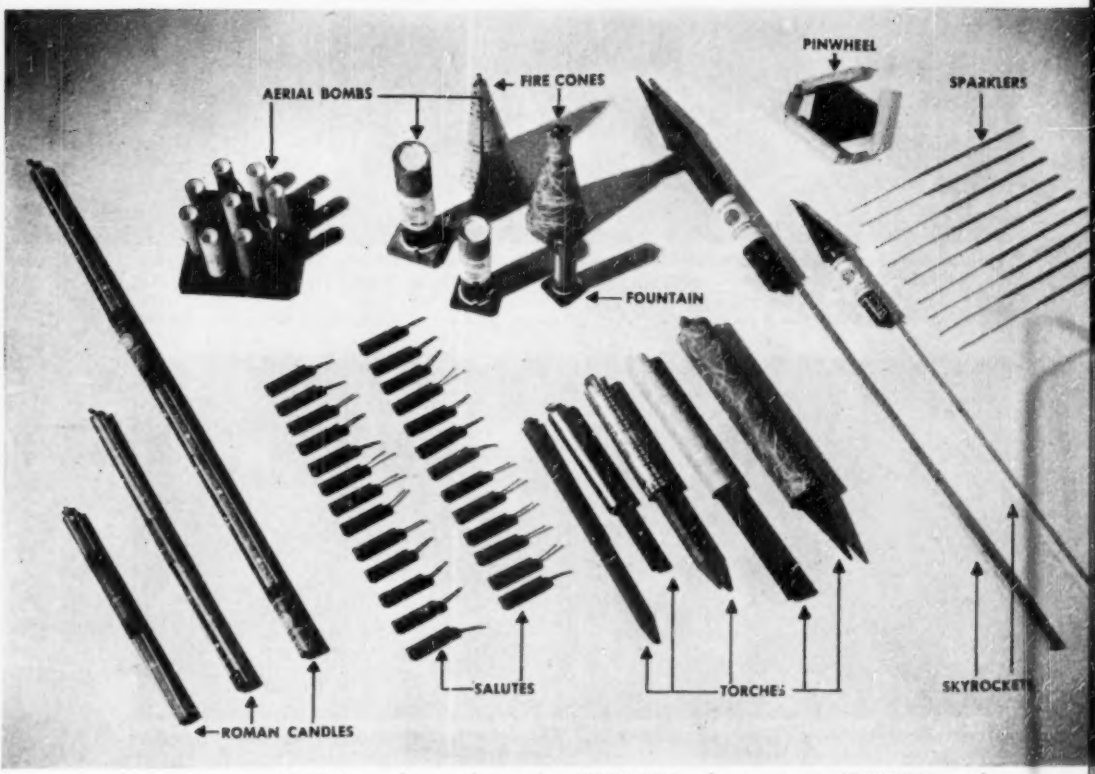
IT WON'T mean a thing to the small fry, but the Fourth of July is getting a little saner. It may even be safer.

The new generation of youngsters is in no position to remember, but their fathers hark back to the days a quarter of a century ago when a kid could set off one of those big, yellow cannon crackers without bringing the cops. Today firecrackers are illegal in 32 of the 48 states. The law has cracked down.

I motored to Cranbury, N. J., last month to find out what, if anything, had happened to the Fourth of July industry in the last 20 or 30 years. Bill Hayward told me. He runs the world's biggest pyrotechnic factory, owned by the Unexcelled Chemical Corp. Like all plants dealing with explosives, it is set off on an isolated parcel of land surrounded by a high wire fence. Its 600 acres is a forest of small buildings, some of them only big enough to hold one workman. There's a reason for that—if one building blows up, it won't set off the others.

Bill said the same things that were popular away back when are still the best sellers today—Roman candles, rockets, sparklers, and a 2-inch firecracker called a salute. But something new has been added. A whole new line of safe-and-sane fireworks gradually is gaining favor with the public. These consist of gimmicks that you stick in the ground and light to produce fountains of fire. They're pretty, but give me the cannon cracker that scared the pants off a motorist when you tossed it under his car.

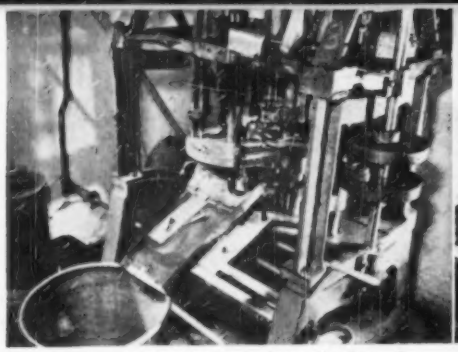
July Fourth may be saner but I'm not so sure it's safer. At least it's not *absolutely* foolproof. I burned my hand with one of the items in the accompanying photo layout.



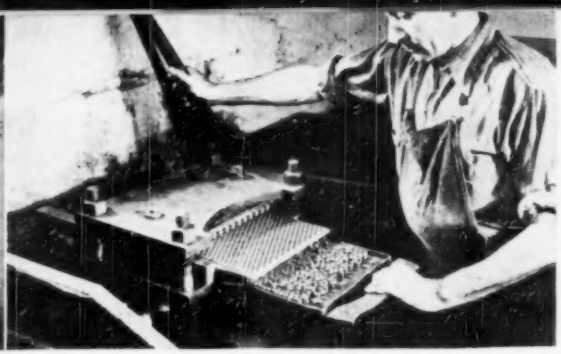
In most states today's fireworks are designed for eye appeal. The world's biggest factory makes 100,000,000 salutes a year, 35,000,000 sparklers, and upward of 3,500,000 Roman candles.

Rolling and pasting paper tubes and cones is first step in manufacture. Here Roman-candle tubes are rolled by hand-fed machine. Thickness of walls depends on the explosive used.

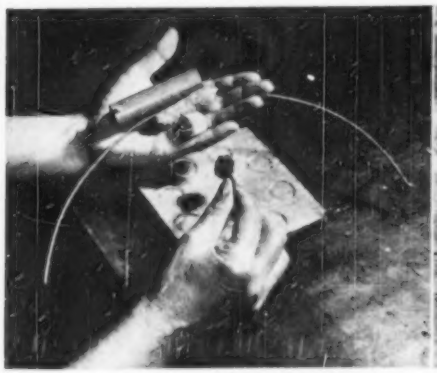
This machine does same job automatically. Other steps in process are mixing chemicals, loading, ramming, assembly, pasting on decorative paper, packing. *[Continued on next page.]*



Automatic rotary plate machine feeds in firecracker tubes, crimps bottoms to seal, puts in about 10 grains of powder, fuses, crimps tops, and expels finished product for packing.



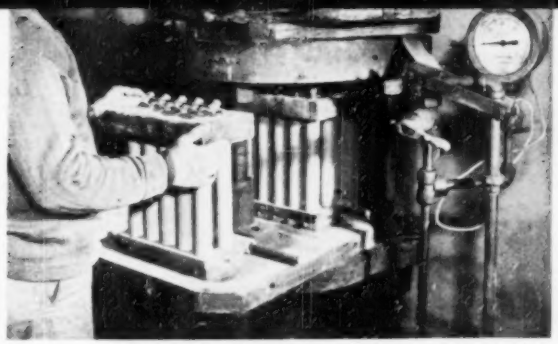
Multicavity mold forms Roman-candle pellets. Burning element is potassium perchlorate. Red fire comes from strontium nitrate; green, from Paris green and barium, potassium chlorates.



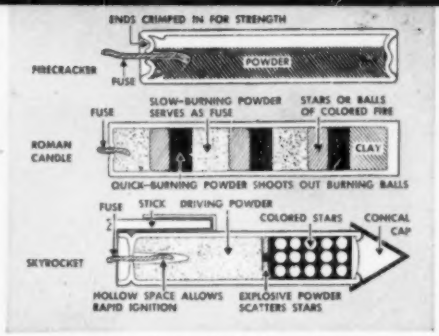
Into final assembly of 9-shot aerial bomb go tube, fuse, powder, and cup-shaped paper seal. Fuse, circling indentations on wood base where tubes are glued on, sets off bombs one by one.

To get a bigger bang out of bomb, powder in 2-inch salute is confined more tightly by dipping cracker in silica gel and rolling it in sawdust. Drum in background does this coating.

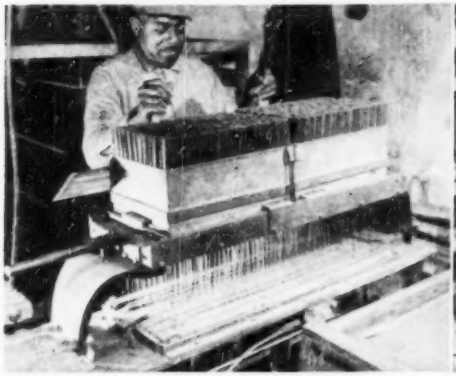
Like most fireworks making, final assembly of aerial bombs is by hand. Rate of burning in explosives is controlled by secret formulas. This factory, with 350 workers, 125 buildings, made munitions during war and now is also engaged on certain defense projects for government.



This hydraulic ram compresses powder in skyrocket tubes for better propulsive effect. Indicating strength of tubes, dial at right shows pressure of 10 tons per square inch.



Construction of standard fireworks items has not changed with passing years. Drawings above are identical with some used to illustrate a POPULAR SCIENCE MONTHLY article in 1930.



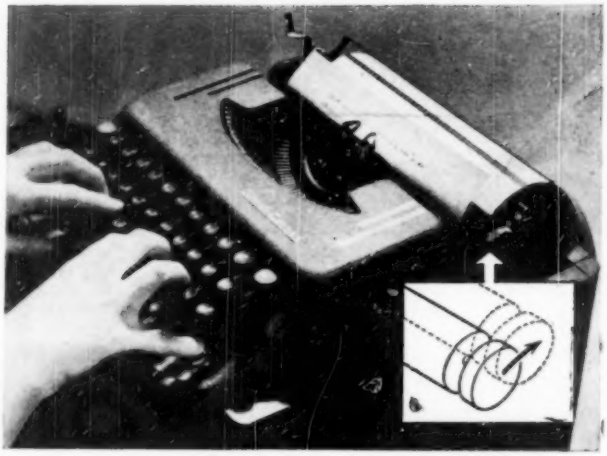
Sparkler making starts with lengths of soft wire. Wires are shaken through perforated box into dipping frame and locked in. Wire gauges start at 18, differ with length of sparkler.

Sparklers are dipped, dried, dipped again. Solution consists of aluminum powder and barium nitrate as burning elements, iron filings to produce sparkle, and dextrine as a mucilage.

Final step in fireworks factory, as in any other manufacturing process, is packaging. Here sparklers are being put in boxes for shelves of retail stores. One worker packs 35,000 a day. Fireworks sell best in northern states for July 4th, but in South it's for Christmas.

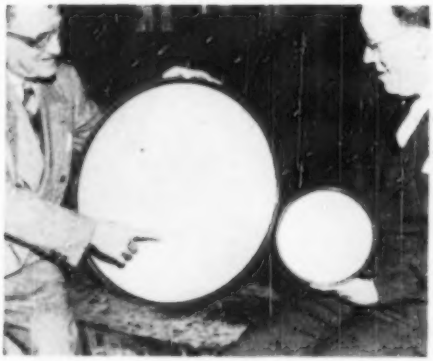
Portable Machine Has Fewer Parts

THIS new nine-pound portable typewriter is small enough to fit in your desk drawer, say the makers, L. C. Smith & Corona Typewriters, Inc. Fewer parts are required by the Skyriter, thanks to its type-shifting mechanism that rocks the carriage backwards, as shown in the inset at right, instead of depressing the type basket—the method used in some conventional machines to shift to capitals.



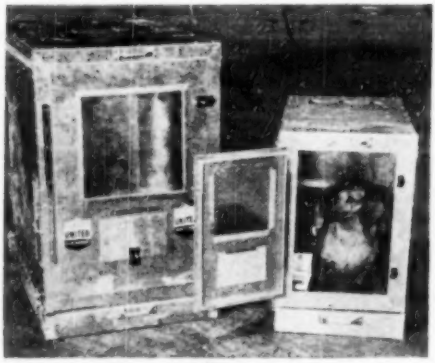
Gadget Aids Golfers

SHAPED like an enlarged key and carried on a key chain, the gadget at left does 12 different jobs for golfers. It has a sharp edge for roughing-up a club's grip or digging dirt out of its furrow markings. It even provides a wrench for tightening shoe spikes. Numerals on the side of the device indicate average distances for various iron shots. Parpal Co., of Toledo, O. sells the gadget for about $1.



TV Tube Big As Newspaper

GENERAL Electric this fall will begin producing a television viewing tube almost as big as a standard newspaper page. It will be made only in limited quantities at first. In the picture above the new tube is being compared with one 8½ inches in diameter. The new tube provides better detail and brightness and operates at lower voltages.

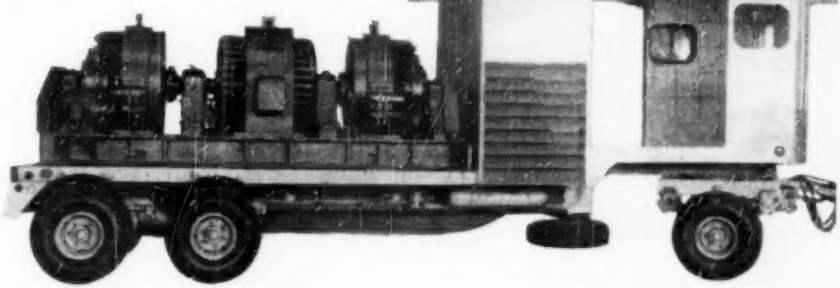


Dog House Made for Planes

A NEW kind of dog house—called a "flight kennel" by its originator, United Air Lines—is being put into service coast-to-coast so dogs can fly with their masters. Heretofore, many of the airlines have restricted dog shipments to all-cargo planes. Built of lightweight metal, the kennels are carried in a plane's cargo compartment.

Power Towed to Movie Set

TOWED to any studio or location, a new mobile power plant turns alternating into direct current for the big arc lights of color-movie sets. A retractable six-foot tower atop the 12-feet-high, 24-ton trailer, which was designed by engineers of Walt Disney Productions, aids in tapping high power lines, as at right. In the view below, part of the all-aluminum body has been removed to show the Westinghouse-built motor-generator set. A single AC motor at the center, connected to the power line tapped, drives a pair of DC generators delivering 300 kilowatts. Special insulation prevents interference with sound camera.



Tiny Detector Tracks Cancer

SO SMALL that a patient can swallow it, the miniature Geiger counter below may help to detect cancer of the stomach. It was developed by Drs. Seymour Gray and Charles Robinson, members of a Harvard University research group. Several times as much radioactive phosphorus, they have discovered, is taken up by stomach cancer tissues as by normal tissue. So they propose administering it and tracing it with the Geiger counter to detect and locate a cancer.

New Jets Race "Upstairs"

NEW afterburners are enabling the F-89 interceptors of the U. S. Air Force to really get upstairs in a hurry. "Sensational" is the phrase used to describe their climbing. The afterburners are enlarged pipes, seen below, behind the turbojet engines. They inject raw fuel into the exhaust stream, and its burning boosts the original 4,000-lb. thrust of each engine by more than half again. The Air Force has revealed that the planes operate in the 600 m.p.h. range.

Restoring historic Williamsburg to its Colonial charm and beauty called for handmade bricks—and the rediscovery of a lost craft.

Solved: Early-American Brick

By Walter E. Burton

DRIVING along a short, deep-rutted stretch of one-way dirt road leading from a pavement near the outskirts of Williamsburg, Virginia, you come suddenly upon a scene that would have been familiar to a Washington or a Jefferson or to any other pre-Revolutionary citizen of the bit of Colonial England that was to become the U.S.A.

For there you see men making brick by the same methods and with the same kinds of equipment and materials used by Colonial brickmakers. You watch a seemingly unhurried manufacturing enterprise whose greatest production difficulty is to keep from making "modern" brick.

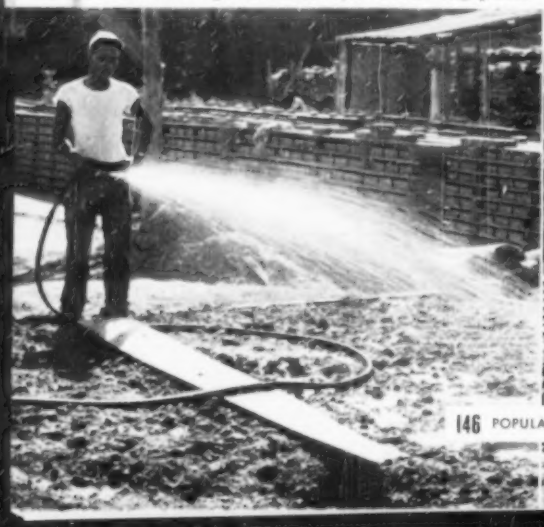
Bricks became a big problem when the restoration of Williamsburg to its Colonial-days appearance was first undertaken in 1926.

The restoration plans, launched with financial aid provided by John D. Rockefeller, Jr., called for the duplication of materials, shapes, colors, and appearances that existed in the original buildings. Wooden structures and building parts could be reproduced with relative ease, and even paint colors could be re-created, but nowhere in the world could modern brick be found to match that surviving in the 18th-Century walls, foundations, and chimneys still standing at the former capital city of Virginia. To repair, restore, and rebuild the old houses, taverns, governor's palace, capitol building, and garden walls, hundreds of thousands of "new" 18th-Century brick would be needed.

Studies of old records and excavated material showed that the brick used was made on the spot, from the Tidewater clay dug within the town itself. So the restoration experts decided that to get new bricks to match in color and texture the original ones it would be necessary to manufacture them from Williamsburg clay by the methods in use 300 or so years ago. But who could make Colonial brick in this modern day?

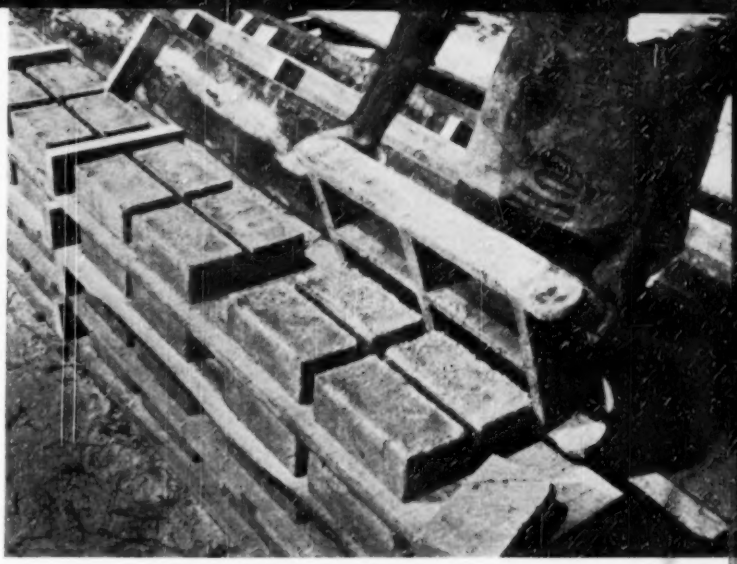
Someone remembered a North Carolina brickmaker who had, on previous occasions,

Wetting down clay that has been brought from Williamsburg to the nearby brickmaking plant.



Clay for the bricks is mixed in this primitive pugmill. Power for it is supplied by the mule.

Mystery



Immediately after being molded, the clay billets are dumped on boards as shown at right. These billets are slightly larger than finished bricks to allow for shrinkage during the drying period.

turned out true handmade brick for restoring old buildings. So Nathanial Hedgecock was persuaded to abandon his regular business of making modern brick at Winston-Salem, N. C., and to take charge of brick production for the restoration of Colonial Williamsburg.

He says that his biggest problem is to keep from making modern brick, and he explains that every labor-saving shortcut that tends to creep into the work has an effect on the final appearance of the product.

Glazed-end brick, for instance, provided just about the toughest problem. The original walls of the Capitol and other buildings contained glazed headers. These were bricks placed so their ends were exposed and those ends were covered with a glass-like glaze that made a wall glitter in the late afternoon sun as if it were set with iridescent jewels. Various chemicals were tried and countless burning experiments were carried out before the answer was found to be simplicity itself. The glazed bricks were simply the ones stacked in the kiln so their ends were fused by the hottest part of the fire!

The first step in making a brick to duplicate a Colonial original is to get suitable clay. Throughout the Tidewater section of Virginia, Hedgecock explains, clay suitable for making excellent brick is available. But only in Williamsburg itself is found the

The brick molder stands in a pit so that his hands will be on a level with the pugmill.

Bricks in these stacks are air-drying. After about two weeks they are hauled to the kiln.

The kiln above is a replica of those used in Colonial times. When it has been loaded with about 60,000 air-dried bricks, the open front will be bricked up and wood fires started.

Inside the kiln, brickmaster Nathaniel Hedgecock examines an air-dried brick before firing. Opening behind him is used to feed wood to the kiln fires. Inset at left shows a glazed header brick that puzzled brickmakers for a long time. Now they've found that the glasslike coating at the top end forms on ends of bricks that are closest to burning wood during firing.

clay that will produce the desired colors and textures. So clay is dug in the city and trucked to the brickmaking plant a mile or so out in the country.

There it is dumped into a pit dug in the ground, watered down by sprinkling, and kept wet for a week. No screening is done, but care is taken not to include large stones, old brick fragments, or other undesirable material. After a week in the pit, the clay is transferred to the pugmill.

This mill, built strictly along Colonial lines, is a crude-looking affair consisting of a boxlike container about four feet high and built of rough boards. Inside it rotates a vertical wooden post studded with iron bars. Power is provided by a horse or mule walking in a circle, the animal being hitched to a boom extending out from the post. Water is added to the clay in the pugmill, and after thorough mixing wet clay of exactly the right consistency for molding oozes from an opening at the ground level.

The molder stands in a pit dug in the ground, so his hands will be at a comfortable level. He picks up a cone of clay, long experience enabling him to judge the quantity accurately, rolls it in sand, and plops it into a wooden mold that has been dipped into water and and then into sand. He presses the clay firmly into the mold cavities and levels the exposed surfaces. A molder can shape 3,000 bricks a day.

The clay billets, somewhat larger than

the finished bricks will be, to allow for shrinkage in drying, are dumped immediately from the molds, piled in rows on board shelves, and allowed to dry for about a week. Although the "green" bricks shrink considerably during the drying, they hold their size well during the later firing. Some crack during handling or drying and are thrown back into the pugmill and reworked.

The wood-burning kiln in which the bricks are fired for 10 days is a house-size brick-and-mortar structure having a removable wall and a series of fire openings extending along two opposite sides. The air-dried green bricks are stacked carefully to form tunnels connecting these openings, and spaces are left between each brick so heat and gases from the fire can work upward among them. When some 60,000 bricks have been stacked in the kiln, the open side is closed with a wall of bricks and clay mortar. Wood, mostly oak or other hardwood, is the fuel.

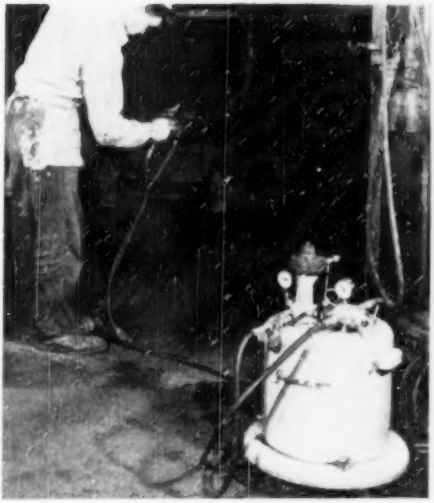
In the 10-day burning, the bricks become white hot, and the surfaces of those nearest the fires actually melt and become transformed into a sort of glass--producing the famous Williamsburg glazed headers. After the firing period, the kiln is allowed to cool, and then the wall is torn out and the finished bricks wheeled to storage piles.

Weathering Mellows the Brick

No attempt is made to "antique" the bricks made for the restored buildings, but Hedgecock says that the longer a brick can be left to weather, the better it will look. Some of the ones he has made have been stockpiled for 15 years, and eventually will be incorporated into buildings. The action of sun and weather darkens the brick surface and produces a mellower appearance, whether the brick is in a building wall or a storage pile.

The problem of re-creating old Colonial walls and chimneys does not end with the firing of the kiln. According to Hedgecock, a piece of brickwork can be made or ruined by the way it is laid up. The Williamsburg restoration is a monument to the skill of modern bricklayers as well as to the brickmakers.

The cost of producing modern Colonial brick in the true "handmade" way is many times that of making modern brick by present-day production methods. But, after a visit to Williamsburg you will agree the final result is worth it. END



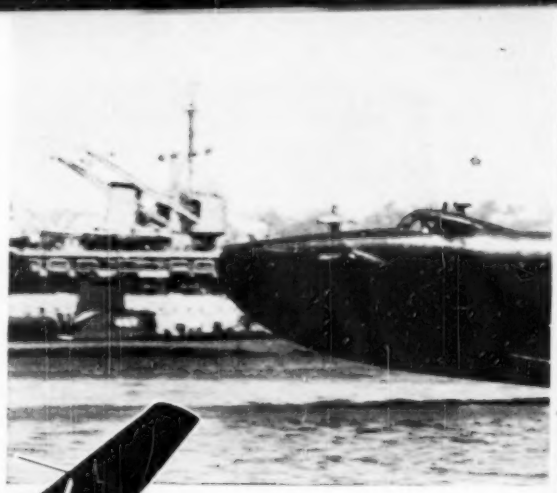
Paint Can Is Spray Source

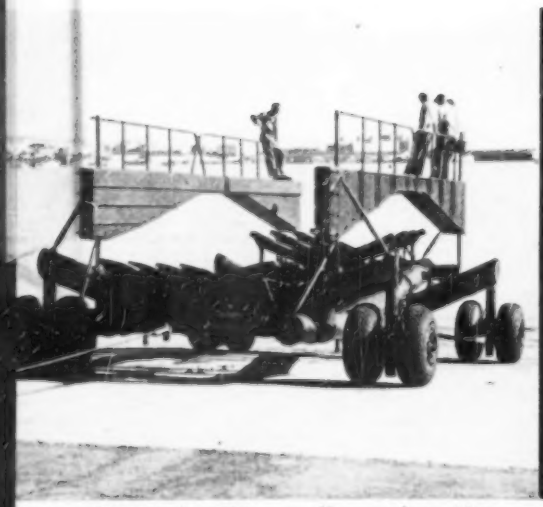
THIS workman is spray-painting furniture with a Paintmaster that fits right over the original container—doing away with messy paint transfer. Made to fit either 5-gal. cans or 55-gal. drums, the units have agitators to keep the paint always stirred. A rotary air-driven pump—not air pressure on the paint—moves the paint to the gun. Lower pressures are said to cut "overspraying." Gray Co., of Minneapolis, makes it.

Scooter for Package Pickup

THE three-wheeled Globster pickup pictured above is powered by a Continental Red Seal engine with Maximatic (automatic) transmission, said to provide quick starting, good cruising efficiency, and easy hill climbing. The manufacturer, Globe Corp., of Joliet, Ill., claims the 215-pound vehicle is easy to park and can turn in a six-foot circle.

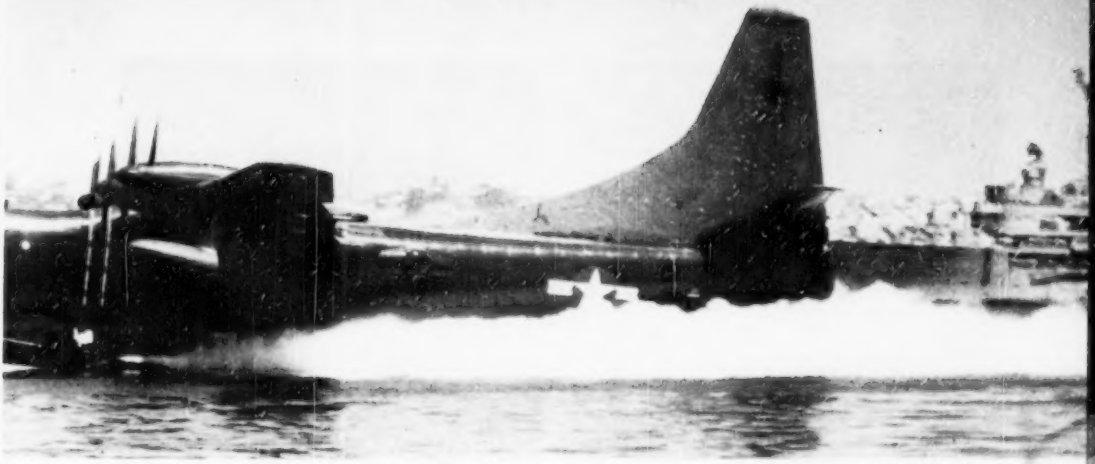
World's First Turboprop Flying Boat





Plane's launching cradle, weighing 15 tons, has its own air brakes, rolls on eight tires. Secret of boat's performance is high power and slim hull, obvious in the flight photo above.

XP5Y-1 rolls tailfirst in cradle down ramp into San Diego Bay. She can carry rockets, mines, torpedoes, bombs, other weapons. Armament includes cannon in four sides, one tail turret.



Navy's newest flying boat "planes" on water only 10 seconds after pilot opens his throttles.

THE world's first turboprop flying boat, a 60-ton mammoth with a top speed of more than 350 miles an hour and a bow like a cruiser, took to the air the other day from San Diego Bay in California. Its performance was nothing at all like that of a conventional flying boat. In a shade under 20 seconds after the pilot poured the coal into its four engines, the huge patrol bomber was airborne. That's only about two seconds slower than the take-off time of an Air Force F-80 jet fighter.

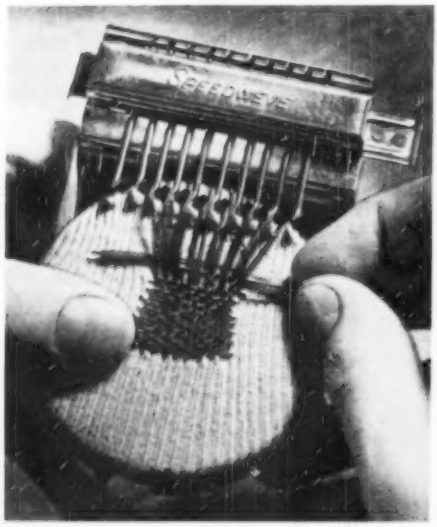
First of a new family of hulls built for the U. S. Navy, the Consolidated Vultee XP5Y-1 can be landed in waves eight feet high. Designed for long-range antisub and search-rescue missions, it is powered by four Allison XT40-A-4 gas turbine engines.

Engines supply 22,000 shaft horsepower for 8 contrarotating props. Exhaust gases give added thrust as they issue from engine tailpipe. Search gear includes both radar, counter-radar.

Plane's tail rises more than 40 feet with hull in cradle. Hull's aft sweep upward helps break water suction at take-off. Plane can tote 2½ times the load of Navy's wartime Coronado boat.

Jets Get 1,000-Mile Tanks

MOUNTED on bomb shackles under the wings, two extra 230-gallon fuel tanks now boost the combat radius of the U. S. Air Force's Republic F-84E jet fighter beyond the 1,000-mile mark. They supplement auxiliary wing-tip fuel tanks of the same design and capacity. The latter, together with fuel carried within the craft, gave it a previously announced combat radius of 850 miles. The newly equipped plane (above) can drop all four external fuel tanks in flight for maneuverability in combat.

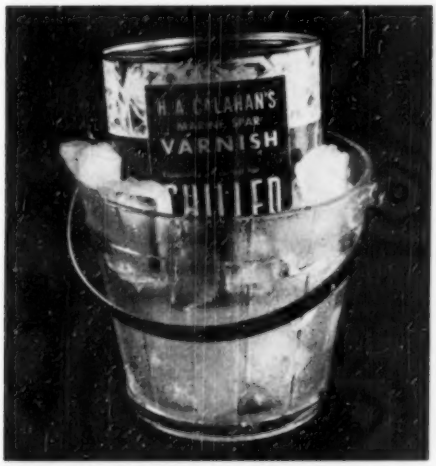


Tiny Loom Mends Holes

CALLED the "smallest loom in the world," the British-made Speedweve darner above makes short work of darning holes in silk, wool, or linen. Mechanism seen at the top of the picture alternately raises and lowers the rows of threads, reweaving the fabric as shown. To illustrate the operation of the device clearly, new thread of contrasting color has purposely been used. When the color of the mending thread matches the fabric, it is hard to distinguish the rewoven portion from the rest.

Sprinkler Does Many Jobs

FERTILIZER, weed killer, or insecticide may be injected into the stream of a new four-in-one sprinkler, above, from an auxiliary one-quart reservoir of transparent Tenite plastic. The double-armed revolving head distributes plant food evenly over a garden. To kill weeds or bugs, a hand-spraying head on a six-foot hose is substituted. With the plastic jar detached, and the revolving head in place, the device becomes a conventional lawn sprinkler. The Misch Mfg. Co., Mishawaka, Ind., makes it.

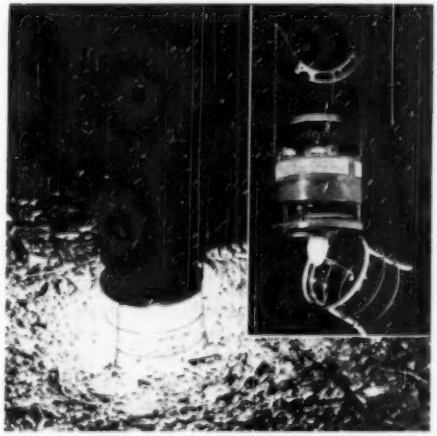


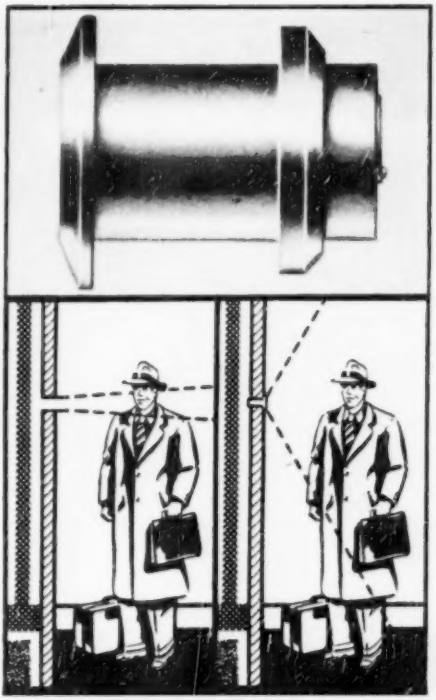
Chilled Varnish Dries Better

You've heard it said that warmth speeds drying of varnish or paint. But H. A. Calahan, of Rye, N. Y., doesn't hold with that theory. He recommends that his marine varnish be chilled before applying.

The varnish is then colder than the surface to which it's applied. This, Calahan claims, causes the varnish to dry "inside out." The part immediately adjoining the the wood dries first. While this is happening, the volatiles are permitted to escape. Last to dry are the nonvolatile constituents that form the tough skin.

The manufacturer says you may or may not get good results from chilling other varnishes. His is especially prepared for such use. It sells for $2.75 a quart.





Peephole Is One-Way Viewer

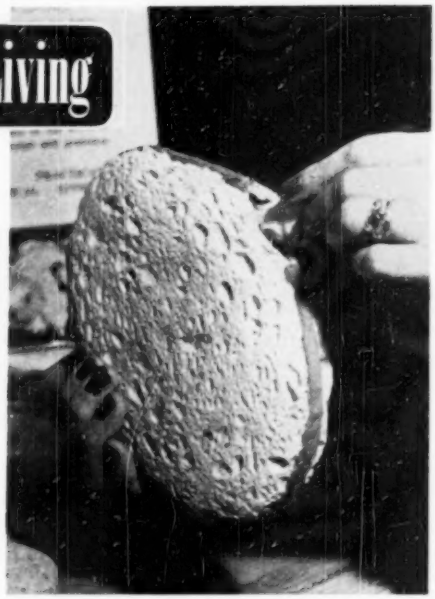
With the peephole cylinder shown at top, you can see not only the head of a visitor outside your door, but get a full-length view, as in drawing at right—and without his knowing it. A system of wide-angle lenses does the trick. Easily installed in a 1¼-inch hole in a wood or metal door, the device has a pivoting shutter on the inner side that closes noiselessly by gravity, and a locking ring makes it tamperproof. The B-Safe Look-out is made by the Danca Products Corp., of N. Y., and sells for about $5.

GI Lantern Is Upside Down

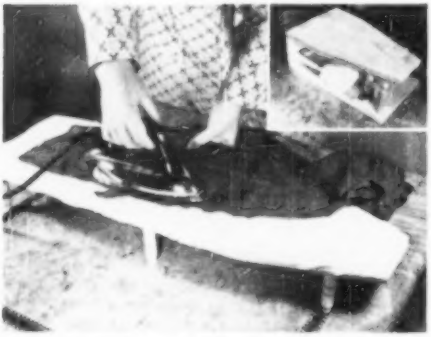
With the light on the bottom and the fuel tank on top, a gasoline lantern developed by the Quartermaster Corps eliminates the shadow usually cast by the tank. The glass globe covering the mantle at the bottom is encased in a metal guard that serves as a tripod for setting the lamp down, as at far left. The handle, seen in inset, is also a wrench for making adjustments. The lantern has been lab tested at temperatures from 69° below zero to 150° above.

Aids to Modern Living

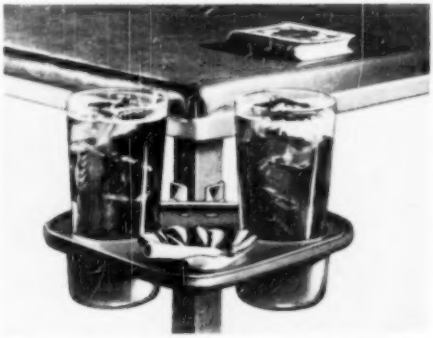
Egg Timer Rings Bell. To time an egg with this device, a sandglass mounted off-center on a disk is swung upward against a metal stop, as above. At time indicated by a minute pointer, sand trickling through the glass causes a shift in weight, pulling the disk downward to hit a bell. Miles Kimball Co., Oshkosh, Wis., prices it at $1.



Sponge Uses Soap Scraps. Left-over soap scraps won't be wasted if they are slipped inside this hollow synthetic sponge, and used for washing clothes or dishes. When squeezed or shaken in water, the sponge turns soap bits into lather. A British product, the new soap-saver comes in a variety of colored bindings.



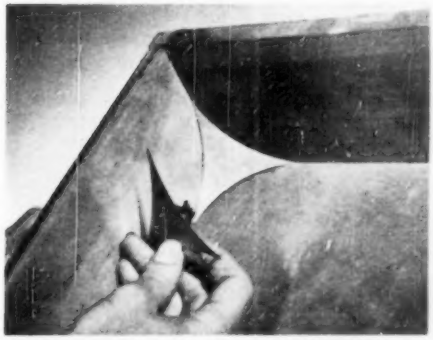
Ironing Board Fits Suitcase. For travelers, or those who have no room for a full-size ironing board, this 27-inch midget folds to 12 inches for storing. An iron and ironing pad can be stored between the folded boards, as shown in inset. Priced at about $3, Tray-L-Bord is made by Andrea Mfg. Corp., of Miami, Fla.



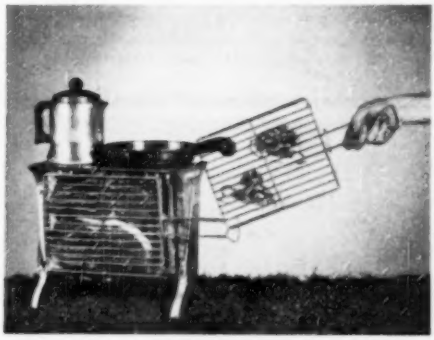
Tray Clamps on Table Leg. Secured to a card-table leg, this serving tray keeps drinks out of the players' way. Made of plastic and chromium-plated steel, it has two deep wells for holding glasses, and space for an ash tray in between. Offenbach and Reimus, of San Francisco, sells a set of two for about $2.80.

Window Has Movable Panels. By adjusting the four-inch, plate-glass panels that make up this window, you can regulate ventilation and avoid direct drafts. The panels are opened outward by a handle, can be locked in any position, and fit into either steel or aluminum frames. Robert Prill, of Chicago, is the inventor.

Bag Keeps Laundry Moist. There's no need to hand-sprinkle clothes for ironing if you put them in this plastic bag. Just stuff the dry laundry in, add a cup of warm water for each five-inch layer, and close the top. In a few hours the clothes will be evenly damp. Humphrey-Callander Co., Clinton, Ill., prices the Damp Champ at $2.



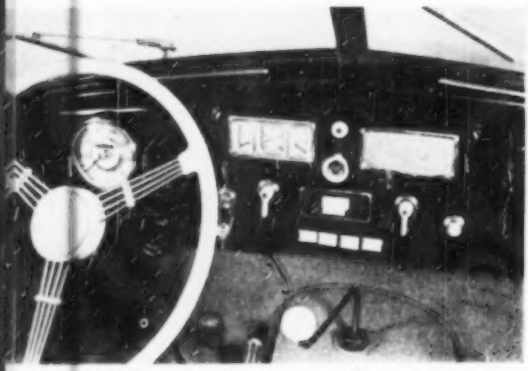
Shields Make Corners Round. Drawer and stairway corners are easy to keep clean when rounded with a triangular metal shield as above. Thumb pressure forces the gripper teeth on the underside to bite into the wood. The Ace Specialty Mfg. Co., of Minneapolis, makes the tan-colored Presto shields to sell for 29¢ a pair.



Barbecuer Has Vertical Grills. This portable, charcoal-burning outdoor cooker prepares a whole meal at once. While steaks or other meats are roasting in vertical, stainless-steel grills on the sides, other foods can be boiled or fried on the top surface. Offenbach and Reimus, of San Francisco, sells the cooker for about $8.

Hansa weighs 2,435 lb. empty. The wheelbase is 102.4 inches, over-all length 175.2 in. American influence is reflected in styling.

Germany Produces 48-Hp. Car



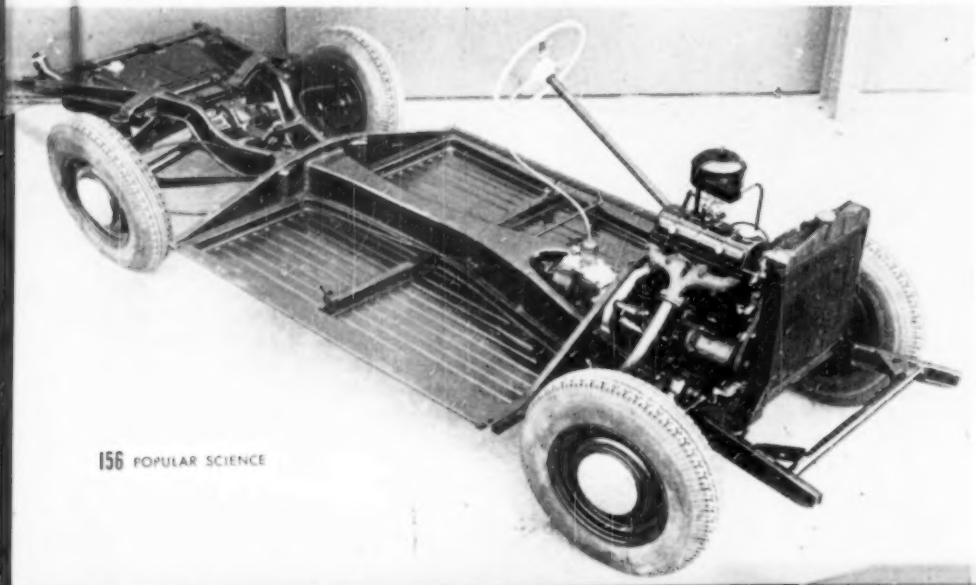
Dash is simple. For manufacturing economy, gearshift lever protrudes from floor tunnel.

A NEW car with a 48-hp. engine that gets 27 miles to the gallon is being produced in Bremen, Germany, by the Carl F. W. Borgward Automobile & Motor Works. Its top speed is about 75 miles an hour.

Known as the Hansa 1500, the machine has "central beam" construction of heavy channel steel. This is combined with a floor pan having three transverse reinforcing members. At front and rear two forks splay out from the beam to provide for wheel suspension and engine mounting. The car has independent springing on all wheels.

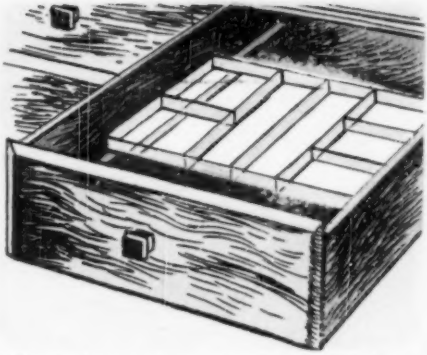
Big by European standards, the Hansa is regarded as one of the bellwethers in the revival of the German automobile industry.

Rugged chassis carries a 4-cylinder, overhead-valve engine. Compression ratio is 6.3-to-1.

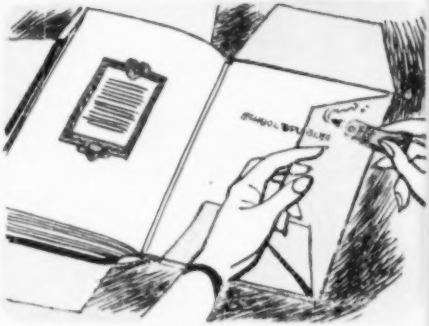


Keeping the Home Shipshape

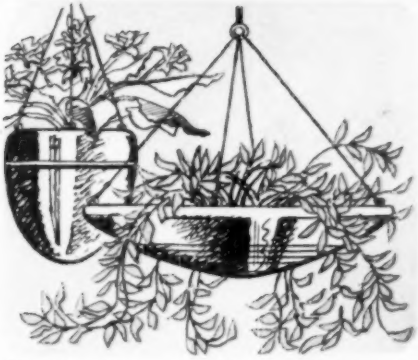
You won't keep pulling the wrong sheet out of the pile if you label each sheet for size. Use laundry ink and print the necessary identification on the hem.



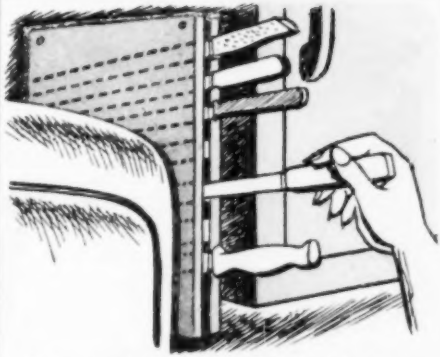
Plastic dresser-drawer trays can be made into sliding trays as shown above. Butt tray sections to width of drawer, and mount on a wood base. Tack rails to drawer sides.



Old plastic tablecloths make excellent protective covers for books. Titles are easily seen through the transparent fabric. Cut the plastic as shown and cement the flaps.



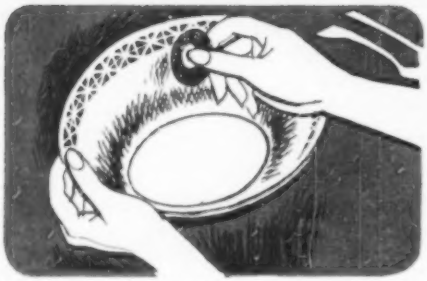
Attractive flower and vine holders can be made from discarded automobile headlamps and hub caps. They're good indoors or out. Polish or paint the metal to suit surroundings.



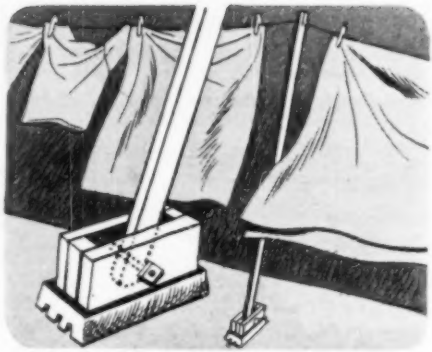
If you need a knife rack but don't have room for a regular one, sandwich cardboard separators between thin boards. The rack, about ½" wide, will fit in any narrow waste spaces.

Please turn the page for five more suggestions.

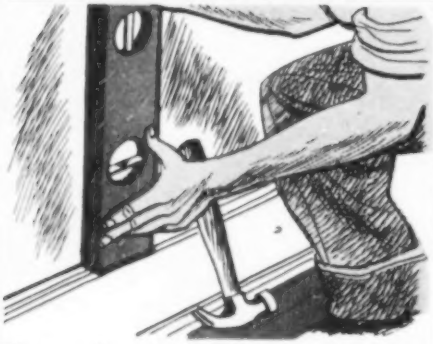
Keeping the Home Shipshape



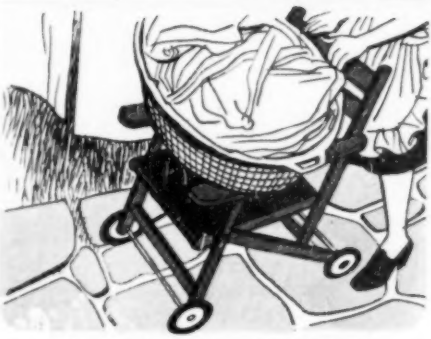
Stubborn stains on silverware may resist efforts to remove them with ordinary cleaners. If soap or polishes fail, try a typewriter eraser. But don't use it on silverplate.



Here's a portable clothes pole that will rest securely on concrete. The base is a wooden frame with a rubber pad nailed underneath. The upright is bolted between the sides.



When you're trying to locate a wall stud to anchor a picture hook, look along the baseboard. Sometimes the nails that hold the base to the studs are visible. Nail directly above.



A handy cart for rolling the wash basket out to the line can be made by attaching wheels to the legs of a folding chair. The chair-cart folds up for compact storage.

If you need a special tint for water-soluble paint and can't find the exact shade in the paint store, try vegetable colors. One of your food colors may be the shade you want.

Mechanics and Handicraft

REG. U.S. PAT. OFF.

The accessories built for grandpa's car are in an automotive museum now. See page 164.

AUTO HINTS

Starting on the next page, you'll find 17 pages of useful information and entertaining reading for everyone who enjoys tinkering with a car.

What can you do with atomic playthings? Kenneth M. Swezey shows you on page 183.

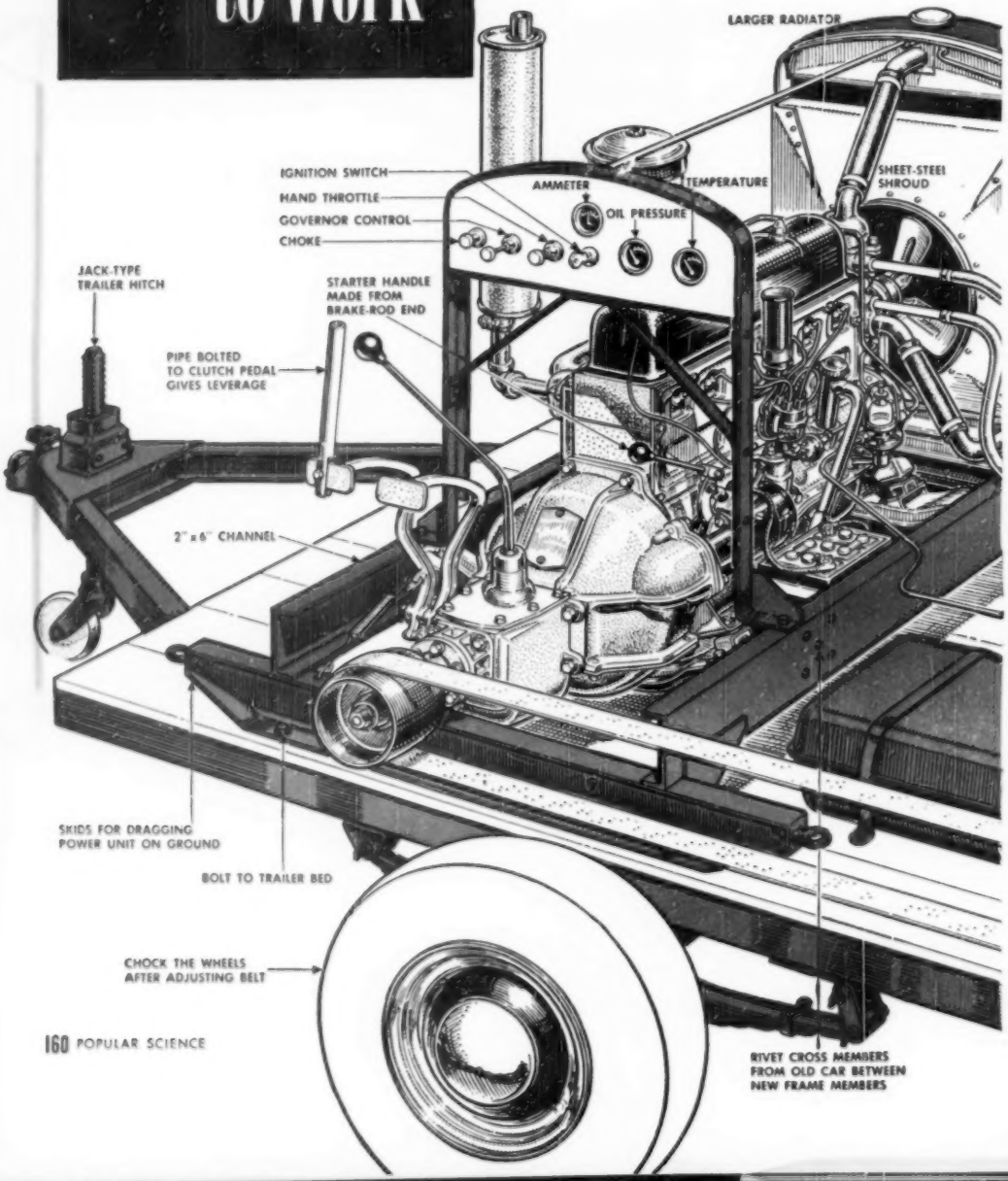
Do you know how to turn a door around? Harry Walton will tell you on page 192.

How to Put Old Engines to Work

By William G. Mitchell
Drawings by Stewart Rouse

A GOLD mine of useful power is piling up today in junk yards and used-car lots. Old car and truck engines, again available there at bargain rates, can be converted into stationary power plants.

Farmers, sawmill operators, and welding-shop owners have long used such engines. Cordwood saws, irrigation and stock-watering pumps, and corn shellers are all adapt-



able to this form of belt power. Small grist mills, planing mills, ski tows, and icehouse lifts can be run with them. Take a look around your place and you may find ways that they can serve you, too.

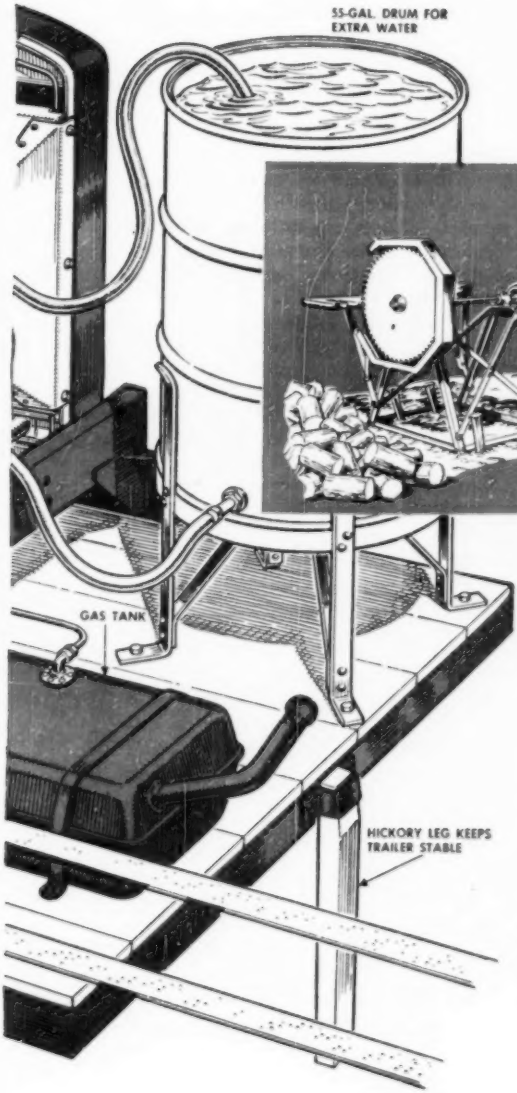
In the big sketch below you see how an ideal power unit might look. It includes practical ideas found in a lot of power plants in actual use. The converted engine in the smaller sketch represents a less ambitious undertaking.

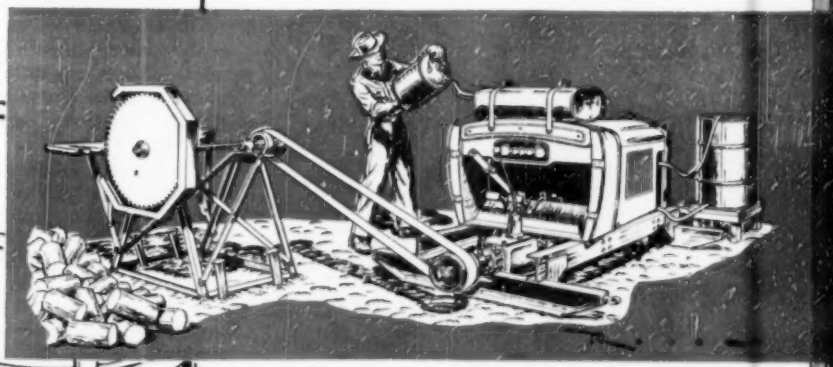
An automotive trailer is suggested if the plant must be moved frequently from job to job. Removing a few bolts frees the trailer for other uses. Skids will enable you to drag the power unit short distances. Eyebolts make hitching easy.

Because every mechanic has his own pet tricks and different engines have their special peculiarities, it's impossible to tell you, step by step, exactly how to make any particular conversion. But there are basic principles you should follow.

What horsepower do you need? Consider this question the first thing you do. The engine should fit the job. You wouldn't use a small engine to power a big sawmill, nor a truck engine to drive a small irrigation pump. If you don't know the power needs of your job, check with someone who does.

In general, don't expect the full horsepower claimed by the manufacturer of any engine. Belt slippage will account for some loss. Then, too, a used engine won't give full power because of wear. Finally, you won't want to run it wide open for long stretches.





Gravity tank makes a fuel pump unnecessary in setup above. Cutting the frame on a line with the transmission and then adding skids is an easy way to adapt a car engine for stationary use. For portable power, you can set the unit on a trailer as at the left. In this case, a new frame is suggested to make the job more workmanlike. A larger radiator, a shroud, and extra water supply help keep the engine cool.

Mounting the engine. This can be done in a number of ways, but whatever you do, make sure the engine is secure.

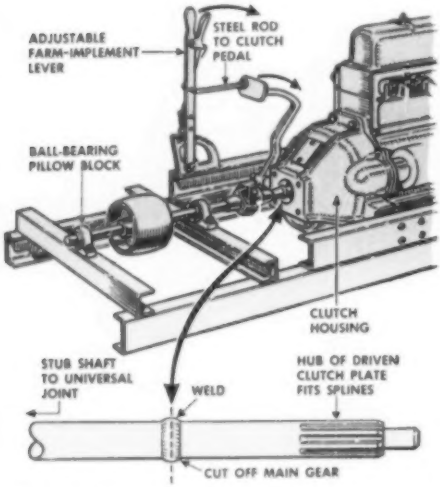
Sometimes a car is simply stripped to the frame, one back wheel removed, a pulley fitted in its place, and the car becomes a power plant. It's usually more convenient,

however, to remove the engine and discard unnecessary parts of the car.

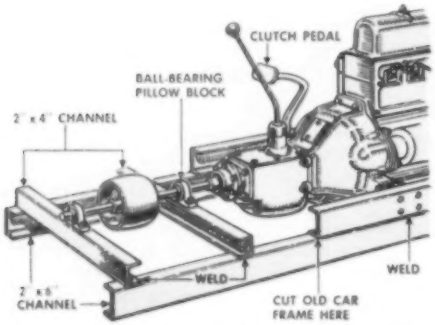
Many conversions are made by cutting the frame on a line with the rear of the transmission, leaving the engine mounted on the front section. Fenders, lights, and windshield are cut off, but the grille, hood, and instrument panel are left.

You can bolt a cut-off frame to a couple of heavy timbers, I beams, or heavy channel steel—preferably runner-shaped at the ends to serve as skids. For a permanent installation, you can then set this on a timber crib or bolt it to a shop or mill floor.

You might also install a new channel-steel frame. Design it so the engine mounts will be the same as before, and be sure to install rubber vibration mounts in the original locations.



If transmission is worn or damaged, remove it and add a direct take-off pulley. To prevent vibration, shafts must be very carefully aligned.



A power take-off coupled to the transmission is more convenient. Several mail-order firms sell the parts required for such a take-off.

For portable power, mount the engine on a one-ton, two-wheel automotive trailer, locating it crosswise as suggested in the drawing on the preceding page. If the engine were set lengthwise, you'd find it a tough job to line up the belt, and even tougher to chock and brace the vehicle to keep it that way.

A Ford engine is excellent for crosswise mounting on a trailer because its length is short. A Chevrolet will also get under the line, although the pulley may stick beyond the trailer wheels a foot or so.

Cooling the engine. A stationary engine requires a different cooling system because you lose the car motion that forces air through the radiator.

Addition of an extra water reservoir, such as a 55-gallon steel drum, is a common solution. Water can be piped to and from the drum through the hot-water heater connections. Sometimes the radiator is eliminated and water from the engine block piped directly to a drum.

You might also substitute a larger radiator. For instance, a large truck radiator will do a good job cooling a Jeep or Model-A Ford engine. For larger engines, use a tractor or regular stationary-engine radiator. This, however, may cost you quite a bit.

Whatever radiator you use, you can improve its efficiency. Increasing the air flow by adding a large, multiblade fan is always a good bet. A smaller fan pulley will speed up the fan, pulling more air through the radiator.

Most commercial power plants have a shroud over the back surface of the radiator. This causes the fan to pull air through the whole surface of the radiator at about the same speed, instead of leaving dead spots near the edges. A shroud is easily shaped from light sheet metal. Leave an opening a little larger than the fan and just in front of it.

Before you put your engine into use, be sure the cooling system is clean. Replace leaky gaskets and hose. Remove the thermostat. Your engine will warm up slowly, but the water will circulate more freely.

The power take-off. For this, it's easiest to leave the transmission in place. You might just fit a shaft to the universal joint, support the shaft with a bearing at

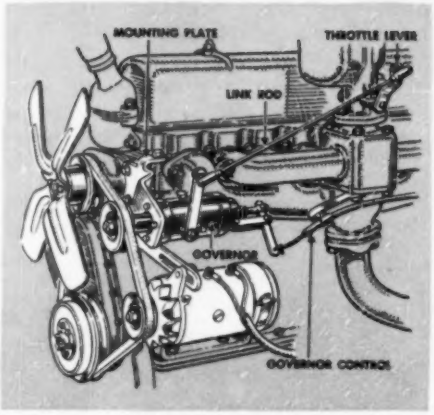
each end, put a pulley between, and the power take-off is complete.

You can often eliminate extra bearings and framing, however, by fastening the pulley shaft directly to the front half of the universal joint as shown in the two drawings in the opening pages. A take-off like this has the advantage of being clear of braces and framing, and it's easier to put the belt on the pulley.

If the transmission of the engine you are converting threatens to give trouble, remove it. Cut the main shaft close to the bearing in the body of the transmission. Weld a shaft 6″ long and of equal diameter to the remaining stub, being careful to line them up. Insert the completed shaft through the clutch assembly as it was originally. Connect this to the pulley shaft by means of a universal joint. The two shafts must be carefully aligned with the crankshaft. Otherwise, you'll get excessive vibration.

Use the original clutch for your power take-off unless some special problem makes it impossible. The drawings suggest a couple of ways you can change the clutch pedal for hand operation.

Install a governor. You need this to maintain a steady flow of power and to keep the unloaded engine from racing. The fly-ball or centrifugal type is probably best. The vacuum type works fine if engine compression is good. With an old engine, though, you can never be sure of that, so the other is usually better. END



One way of installing a governor is suggested above. Specific instructions usually are included when you buy a governor. It's always advisable to use one on a stationary engine.

POINTS TO REMEMBER

When you build a power unit from a used automobile or truck engine:

1. **Choose an engine to fit the horsepower requirements of the job it's to do.**
2. **Mount the engine securely.**
3. **Make provision for proper cooling.**
4. **Assemble an adequate power take-off.**
5. **Install a governor.**

Oil Forced into Hose Speeds Up Sluggish Wipers

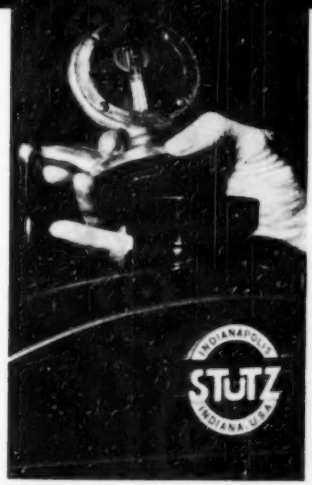
When windshield wipers become sluggish, speed them up with rubber lubricant, the Ford Motor Company advises. Disconnect the hose, squirt in a little lubricant, and apply an air hose. Demonstrating the trick above, a mechanic at Fordham Motor Sales, Bronx, N.Y., said a little No. 10 oil won't damage the hose—vacuum soon cleans it out. Another dodge is to oil the wiper intake and let the vacuum draw it in.

Look What They Used to Hang on Cars

Horses shied when early motorists tooted bulb horns like these. Elaborate affair in center plays four notes when you squeeze bulb once.

YOU can be happy your modern car has chrome trim—and not brass. Polishing grandpa's car was a time-eating job, and so was lighting its lamps. The driver had to stop, get out, and do it with matches. Putting up a "one-man" top usually required patience, luck, two men, and a dead calm.

But caring for auto accessories of bygone days is a labor of love at the Automotive Museum of Henry A. Clark in Southampton, Long Island. He collects lights, horns, radiator caps, window shades, bud vases, and other reminders of the auto industry's younger days. He is shown above with part of his display of lamps; the one he is holding is a self-generating gas headlight from a 1903 Peerless.

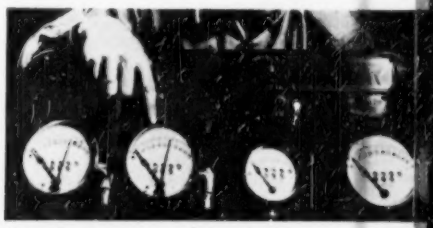


Motometer radiator cap showed engine temperature. It is seen above on a Stutz Bearcat.

Brass lamps in the museum need frequent polishing—just as they did on the old cars. Here Clark works on a side lamp from a 1911 Locomobile. This lamp burned kerosene.

Home, James! A telegraph device from English car enabled passenger to signal the chauffeur to start, stop, turn left or right.

Script nameplates once were all the rage. One above came from a 1910 Schacht motor buggy.

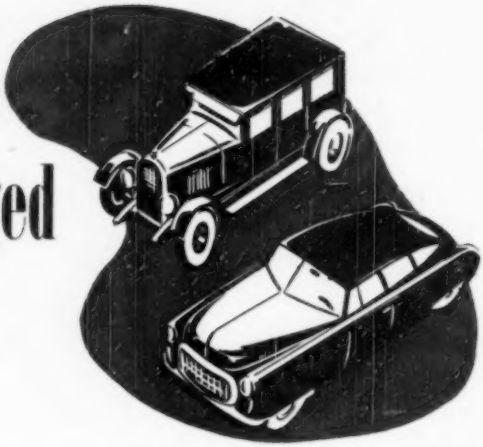


Speedometers were bought separately in the old days. The one indicated here cost $65. It registered speeds up to 100 m.p.h.

Changing tires was a major job. Below, Clark prepares to remove the spare from a 1909 Mercedes. Note spotlight, side lamp, and horn.

In his workshop, Clark puts all his items in working condition. French gadget he's working on below generated acetylene for headlamps.

Why Auto Styles Have Changed



The science behind your low-slung, streamlined car is demonstrated in these simple home experiments.

By Kenneth M. Swezey

AUTO styles have changed as much as women's hats—but for entirely different reasons. The hats have merely followed fashion. The cars were changed to conform to natural laws.

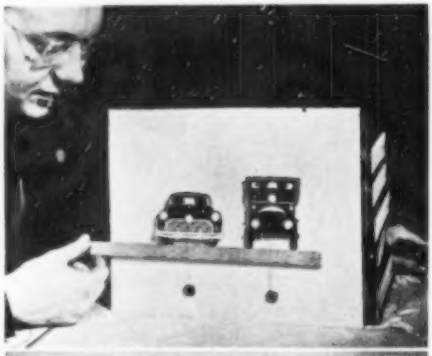
Centuries ago, Archimedes observed that the stability of an object always increases as you lower its center of gravity—the point at which all parts of the object exactly balance each other.

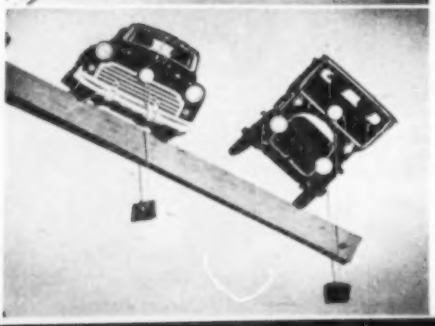
Automobile designers have made use of this knowledge in transforming car bodies from the high, boxlike affairs of 30 years ago to the lower, more streamlined products of today. As Archimedes could have predicted, lowering the center of gravity makes our cars less liable to tip over.

Designers have also taken into consideration the air's resistance to the motion of a car. It increases in proportion to the cube of the speed. This doesn't matter much at 30 or 40 m.p.h., but it becomes very important at 70 or 80. At the higher speeds, an old-fashioned square sedan might need 60 hp. just to buck air resistance. Modern streamlining cuts this power requirement considerably.

Strangely enough, the car makers have found that it's more important to streamline the rear of a car than its front. Turbulent air behind creates a partial vacuum that tends to slow the car.

These stunts show how center of gravity and streamlining apply to your car.





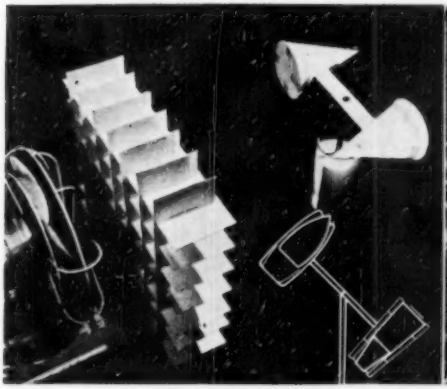
Center of Gravity. How this affects a car's stability can be demonstrated by gluing two car cutouts—one of modern design and the other of a high, old-fashioned type—to cardboard. Press a thumbtack into each, as shown, to indicate the center of gravity. Suspend a small weight from each tack. Stand the cutouts side-by-side on a stick pivoted at one end to a sheet of heavy cardboard. Tilt the cardboard back so the cars won't fall.

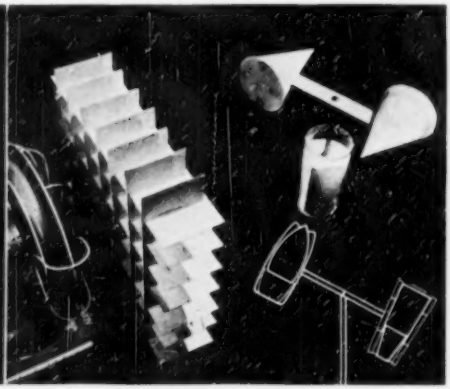
Now raise the free end of the stick and watch the threads that mark the line from the cars' center of gravity to the center of the earth. (It may be necessary to roughen the stick to keep the cars from sliding.) As long as a thread remains inside the car base, the car will stay upright. When it moves outside, the car will overturn. Consequently, you can see that a lowered center of gravity lowers the risk of a highway roll-over.

Streamlining Reduces Drag. To show this, make a right-angle bend near one end of a ¾″ by 3″ cardboard strip and stand it an inch or so behind a square milk carton. Then blow against the opposite face of the carton. This represents an old square-backed car traveling toward you. As you blow, the cardboard will fall toward the carton—seemingly into the wind.

Now substitute a cylindrical can for the carton and repeat the stunt. The can represents a modern streamlined car. In this case, the cardboard will be blown along with the air stream.

When you blow against the carton, a partial vacuum is created behind it. In the same way, speed-reducing drag is produced behind a square-backed car. Around curved surfaces, however, air flows in a relatively undisturbed stream.





Rear or Front Streamlining? By arranging a tug-of-war between two conical paper cups, you can show that streamlining the rear of a car goes farther toward cutting down wind resistance than streamlining the front alone.

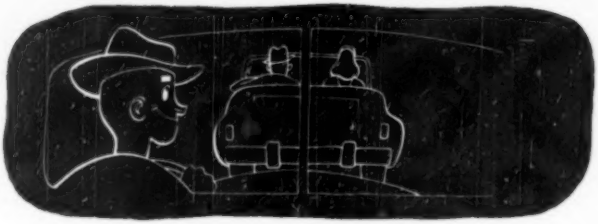
Tape a cardboard disk over each cup. Mount them in opposite directions on a stiff cardboard strip. Pivot this assembly at its center point. Point one cup toward a fan, the other away from it. Smooth the breeze with strips of cardboard fitted together like an egg container.

After the setup is arranged as at the left, turn on the fan. If your centering is accurate and the wind stream straight enough, the cup with its point toward the fan will be pushed back as above. The reason? A partial vacuum is produced by air turbulence behind the flat rear of the cup pointed into the breeze, forcing it back. Less turbulence results behind the other cup. END

Why confuse the other fellow with waving arms?

You Can Build a Turn Signal

Flashing lights will tell the world where you're going.



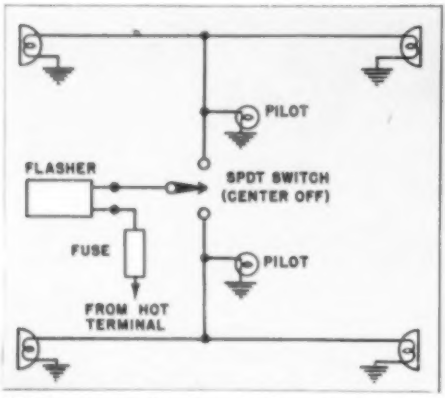
IF YOU can strip a wire, you can install a turn-signal system in your car. It's almost that easy—and the job will pay safety dividends every time you drive.

A flasher unit will be your biggest expense. You can get this at practically any auto parts store for around $2.25. A switch, 16-gauge wire, and perhaps four double-contact sockets are other major parts.

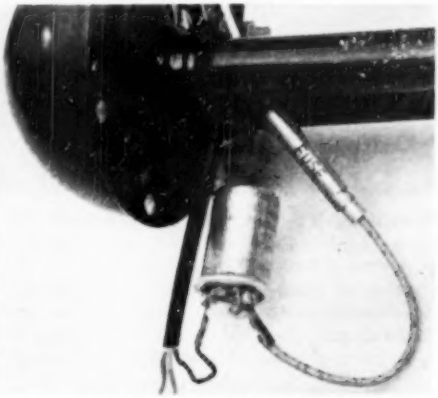
Adding the necessary lights front and rear is the first step. At front, it's usually easiest to adapt the parking lights. If you seldom use them as parking lights, you can simply disconnect them, put in 21-candlepower bulbs, and connect them to your new blinker circuit.

It's better, however, to install double-contact sockets. Then you can use double-filament bulbs of 21-3 candlepower. This means that one filament will provide 21 candlepower (for signaling) and the other, 3 candlepower (for parking).

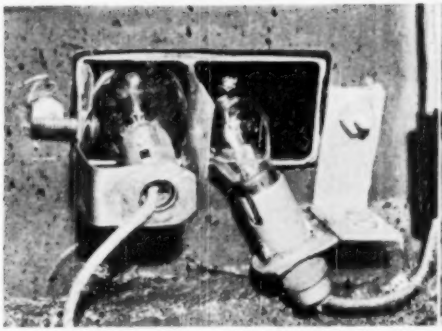
If your stop light is separate from your tail lights, convert the tail-light sockets to the double-contact type and install 21-3 candlepower bulbs. If the car has combi-

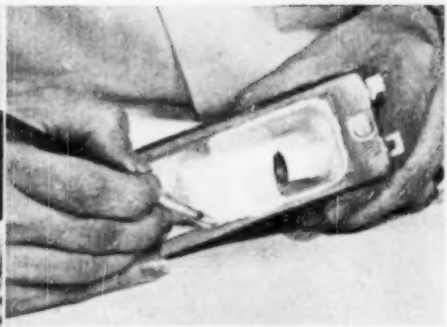


Wiring is simple. Note that you have circuit to each side of car. Unlike factory-installed units, turn lights must be turned off manually.



Flasher unit was mounted on horn bracket in this case. Three-conductor cable can be used between switch and flasher. Hot lead is fused.





A signal light can often be placed within the tail light by installing new brackets for the sockets. Solder a partition between the lights to make the signal more noticeable. Painting the inside of the lamp housing with white enamel, as above, will increase light brilliance.

nation stop and tail lights, you must install separate signaling bulbs.

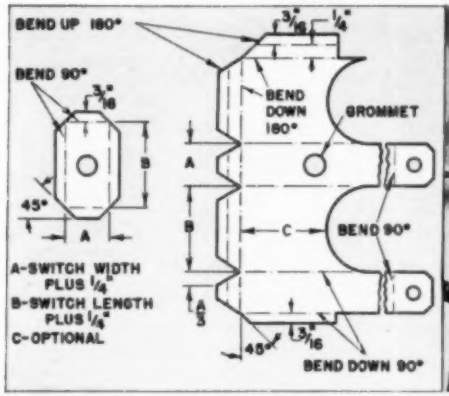
Rather than monkey with the existing lights, you may prefer to add a separate one at each corner of the car. You can buy these in painted or chrome shells. Mount them on the gravel shields or other spot where they will be clearly visible.

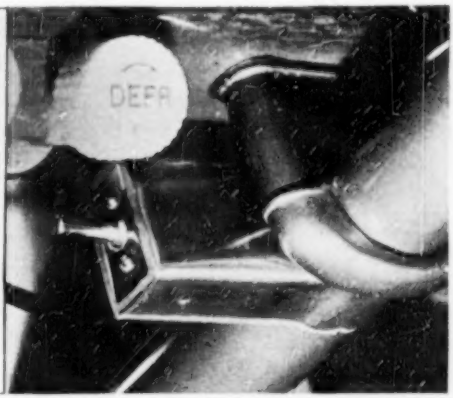
Locate the flasher unit somewhere in the engine compartment so its operating noise won't bother you. The switch can go on the dash or steering column.

Connect your lights in a single-wire system, grounding one terminal. First connect the lights on each side, left front to left rear and right front to right rear. Tape the wire where it may be chafed.

A three-conductor, color-coded cable can be used between the flasher unit and SPDT switch, which must be the center-off type. Connect one wire to the center post of the switch and one terminal of the flasher. Connect the other two to the remaining switch terminals. At the flasher unit, strip the coating from the cable and run the two wires that were connected to the outer switch terminals to opposite sides of the car, connecting them to the wires between the lights. From the flasher unit run another wire, through a fuse of 10 amperes or less, to a hot terminal. Then try the switch. If the lights work okay, solder all connections.

The pilot lights can be connected at the switch. If a single pilot will serve, connect it to the pilot terminal on the flash unit. —*R. B. MacArthur, Compton, Calif.*





Switch housing can be laid out on light sheet metal as above. The size of your switch will determine dimensions *A* and *B* and to some extent *C*. Make the 180° up bends first, then the 180° down bends. Next make the 90° horizontal down bends, including two not marked. Solder the joints. Install switch in housing and bolt clamp arms around steering column.

RAY QUIGLEY

Gus Earns a Holiday

After a day of fishing, a good meal under his belt, Gus the Good Samaritan hears trouble knock. Since it's engine trouble, he finds a quick solution.

By Martin Bunn

KEN Littlefield moved into our neighborhood about six years ago. He and his wife, Joan, had bought the old Marvin farm 18 miles south of town on the west branch of the river, and had converted it into a comfortable country inn for summer vacationers. Whenever Ken came to town for provisions and supplies he always stopped by the Model Garage to fill up with gas and have a chat with the proprietor, Gus Wilson. He and Gus had built up quite a friendship, and the river beside Ken's little rambling hotel had become one of Gus' favorite fishing spots.

Three weeks ago, on one of those hot days we had early in June, Gus glanced up from an ignition job to see Ken's old but shiny station wagon pull up beside the pumps.

"Hi, Ken," Gus greeted. "Got your place in shape for the summer folks?"

"Just about, Gus," Ken answered, as he unlocked the cap to his tank so Stan Hicks, Gus's assistant, could fill it up. "And not too soon either. Our first guests arrive in two weeks. But there's my big problem," he added, pointing over his shoulder.

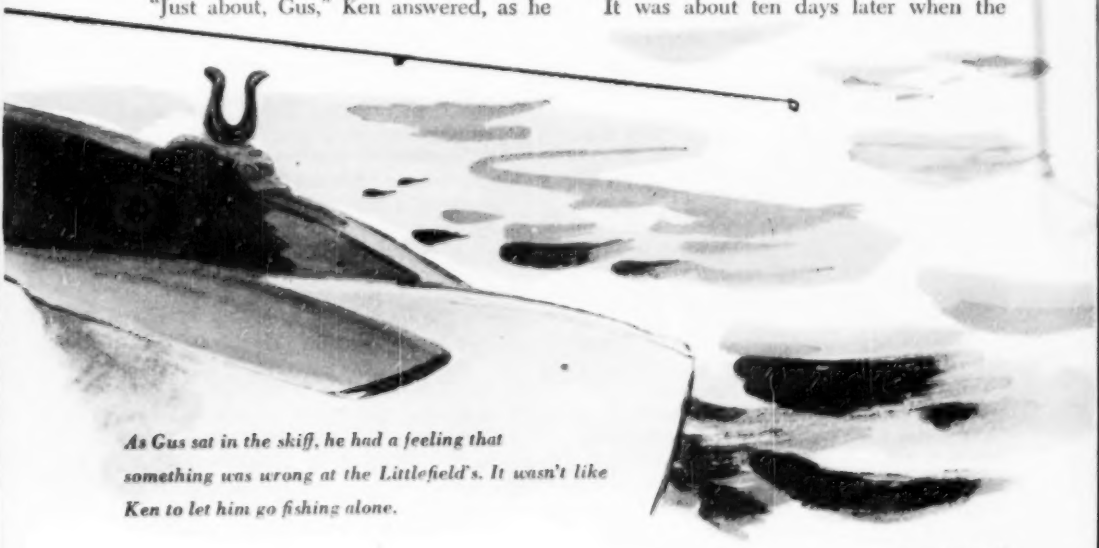
"I was wondering what you were doing with a spare motor in back," Gus said.

"It's a rebored and rebuilt engine for this old buggy. Only cost me $142, plus shipping charges. Now all I've got to do is install it. I figure that with a block and tackle on the barn tie beam, I ought to be able to handle the job. Not that I'm trying to do you out of business, Gus, but this is a time of year when things are pretty tight with us." Gus's smile told him there was no need to worry on that score.

"By the way, Gus," Ken continued, as he paid Stan for the gas, "you haven't been out to the place since last Fall. How about coming out for some fishing one of these afternoons? Joan'll buy you dinner."

"I'll be out," Gus promised.

It was about ten days later when the



As Gus sat in the skiff, he had a feeling that something was wrong at the Littlefield's. It wasn't like Ken to let him go fishing alone.

fishing urge and the promise of a home-cooked meal made Gus decide to take up Ken's invitation.

As he drove along the road toward Millstown—that's the little crossroad hamlet a few miles from Ken's inn—Gus got to thinking about the Littlefields, and what nice people they were. They'd bought the Marvin place on a shoestring, and had done most of the remodelling themselves. Ken was a handy man with tools, and Joan was no slouch with pots and pans or needle and thread. Their first two years had been rough, but the place had caught on. Last summer, their ten rooms had been filled all season.

At this point in his reminiscing, Gus spied Ken's freshly painted sign—Settler's Inn—and turned into the private lane that led to the main house.

"Well, if it isn't Mr. Wilson," Joan greeted him as he maneuvered his car into a parking spot. "I'd almost given up hope of seeing you before we opened."

Ken's Not at Home

Joan hadn't changed a bit in the eight or ten months since Gus had seen her last. Hard work seemed to agree with her.

"Ken isn't here right now," Joan apologized as they climbed the steps to the broad veranda that rimmed the house. "Why don't we just sit here on the porch until he gets back, and you can catch me up on all the gossip."

Gus had just finished telling her about old pinchpenny Barnstable's recent brush with the law when he recognized the Littlefield sedan turning into the lane. Ken had someone with him.

"Here's Ken—and that's his young brother Dave with him," Joan explained. "Dave wants to go into the hotel business when he gets out of college. He's going to work for board and keep for the summer—sort of on-the-job training. It's a break for us."

Ken waved a greeting as he opened the porch door and spied Gus.

"Gus, this is Dave—he's my kid brother."

"Glad to know you, Dave." Gus shook the young man's hand. "Well, Ken, I've taken up your invitation."

"Good," said Ken, "but I'm afraid you'll have to fish alone. Dave and I've a job to do. You know where the skiff's tied up, and the bass and pickerel are running strong."

What's Up at Settler's Inn?

As Gus sat in the skiff, rod in hand, he had a feeling that something was wrong at Settler's Inn. Ken had looked worried and tired, and it wasn't like him to let Gus go fishing alone.

Two hours and three small-mouth bass later, Gus decided he'd better head back to the Littlefields'. He wanted to get back in time to clean his fish, wash up, and be ready for Joan's dinner.

The dinner was one of Joan's usual—chicken and dumplings with lots of thick, creamy gravy, hot homemade bread, strawberry shortcake made with biscuits, and the kind of strong coffee that Gus liked but seldom got in restaurants. Gus was enjoying every mouthful of it when he noticed that neither Ken nor his brother were eating much. He suddenly realized that most of the conversation had been between himself and Joan.

"What's the matter, Ken?" Gus asked. "Something bothering you?"

"Oh, nothing in particular," Ken replied without looking up from his plate.

"Anything I can help you with?" Gus offered.

"No, Gus. It's nothing. It'll work out."

"Now look here, Ken Littlefield," Joan admonished. "You know right well it's something Gus could help you with, and I think you're just being downright childish not to tell him about it. You've been acting like a bump on a log all afternoon, and if you don't tell him, I will."

"Well, there is something," Ken finally admitted. "But I don't want you to think I asked you out here just to—"

"Nonsense, Ken. Let's have it."

"It all goes back to the last time I stopped

by the Model Garage," Ken began. "Remember, that rebuilt engine I had in the back of the station wagon?"

Gus nodded.

"Well, after Dave got here last weekend we spent all our spare time taking out the old engine and getting the re-built job into place. Everything went fine until we stepped on the starter. She ticked right off. But when I idled her back there was a bad knock. After checking everything this afternoon we've decided they shipped us an engine with a bum main bearing. At least that's what it sounds like. About all we can do now is rip it out again, send it back, and wait for a replacement. That means we'll be hamstrung with nothing but the sedan and paying guests due any day."

"Whoa, Ken, maybe things aren't so black," put in Gus. "Mind if I try my ear on this knock of yours?"

Two minutes later, the three men were in the barn.

"There's my headache," Ken indicated, switching on the lights.

As Dave started the engine, Gus stood beside the open hood and listened. The knock was there all right. No doubt about it. Gus reached in and moved the throttle rod to the carburetor back and forth. The noise was just as noticeable at all speeds.

"Doesn't sound so good," Gus admitted. "Got a screwdriver handy?"

Ken handed him a long screwdriver from a nearby bench and Gus used the metal shank to short out one spark plug after another. It had little effect on the noise.

The rebuilt installation didn't include a new head or manifolds, but Gus had worked on Ken's station wagon before and didn't think anything was wrong there. Then he had an idea.

"Have you had that old head off since you first installed it?" Gus asked.

Ken shook his head.

"Let's take it off and have a look at the rebore job," Gus suggested. "You'll have to take it off anyway if you decide to send the motor back."

Ken agreed, and he and Gus set to work. When they had the head off, Gus ran a finger around the inner walls of a cylinder.

"A nice job," he said. "New valves as well as new pistons."

For a moment Gus studied the top of the

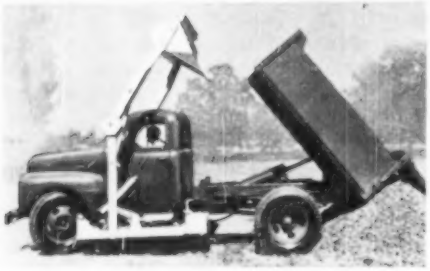
[Please turn to page 226]

Car Gets Station-Wagon Look

OLD cars get a new look with these wood body panels designed to give the appearance of one of those special body jobs. Easily attached by screws over the existing body, the panels are made of mahogany and hardwood veneers and come to fit all makes of cars since 1927. The Bellbod Co., of Brooklyn, N. Y., sells 2-door kits for $175.

Father-and-Son Team Builds Homemade Roadster

THIS snappy homemade roadster, built by R. E. Daniels and his father, of Wichita, Kans., boasts a distinctive body formed entirely of new sheet steel. Grille, windshield bracket, and front bumper were fabricated in the father-and-son machine shop and then chrome-plated. Engine is a stock '48 Mercury, except for an Edelbrock Super manifold. Transmission is Ford with '48 Lincoln gears and a two-speed rear axle.

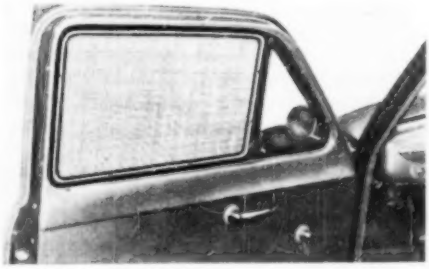


Dump Truck Is Self-Loading

WITH the hydraulically operated bucket shown above, loading a dump truck becomes a one-man operation. The loader scoops up material and delivers it to the truck bed over the cab top. The operator can even do light digging or grading. Shown at left in vertical position for dumping or driving, the attachment, made by the Ernest Holmes Co., of Chattanooga, Tenn., can be installed on most standard trucks.

New Auto Screen Foils Insects

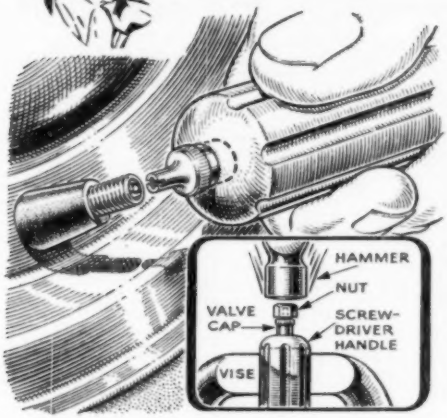
THE Auto-Screen in photo at right permits the outdoorsman to take a nap in his car with plenty of ventilation but without annoyance from insects. Designed to fit any car window, the screen consists of a strong mesh netting encircled by a light spring steel frame. The frame adapts itself to a window's shape; a take-up device lengthens or shortens it. The screen is made by the Mocar Products Co., of Dearborn, Mich.



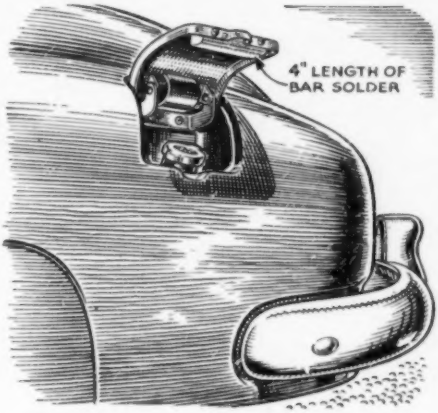
Gas Pump Is Silent Salesman

A LIGHTED sales message moves continuously across the top of a new gas pump, as shown in photo sequence above. Simulating the illuminated news bulletins that travel around a building in New York's Times Square, the device repeats its 55-character message five times a minute. The ads are carried on an endless, plastic-impregnated fabric tape. Gilbert & Barker Mfg. Co., West Springfield, Mass., makes Sell-A-Vision.

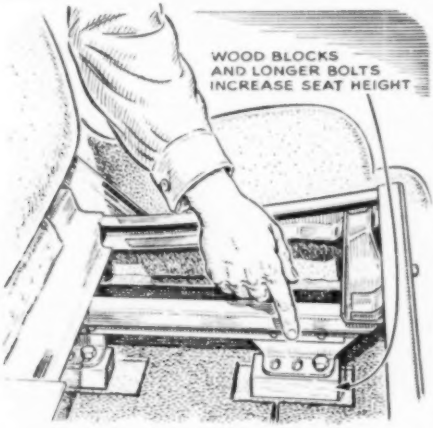
Hints from the Model Garage



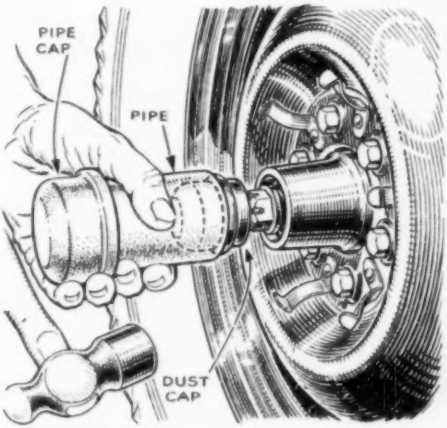
Keeping Valve Cap. A valve cap embedded in a wooden screwdriver handle keeps it handy in your tire-repair kit. Holding the screwdriver in a vise, slip a protective nut over the valve-tool end of the cap and drive it into the wood.



Weight Keeps Cover Closed. Gusts of wind swirling under the fender at high speeds sometimes blow the gas-filler door open, especially if the spring is weak. Weighting the lower door edge with a screwed-on piece of bar solder holds it shut.



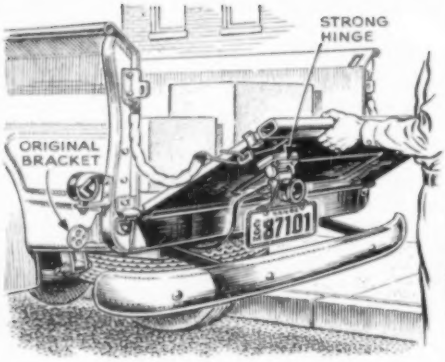
Blocks Raise Low Seat. In certain new cars, the front seat is so low that some drivers have difficulty seeing over the hood. John H. Brichetto, of Knoxville, Tenn., solved the problem in his car by installing a wood block 2" thick under each corner of the seat rails. The new bolts must, of course, be longer than the original ones.



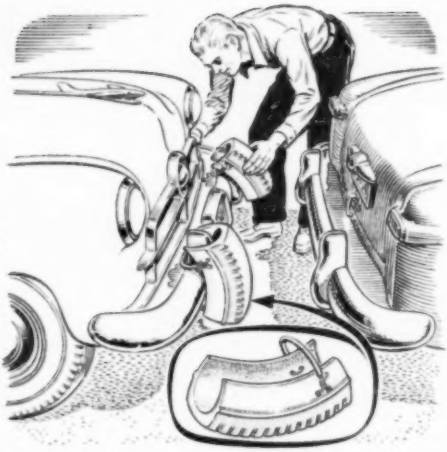
Tool Puts Dust Cap in Place. A piece of 4" pipe makes an ideal tool for returning the dust cap to position after you've packed the front wheel bearings. Thread one end of the pipe and cap it. Rest the pipe on the flange and tap gently until the dust cap seats. Using a hammer directly is apt to damage the dust cap.

Turn the page, please, for four more auto hints.

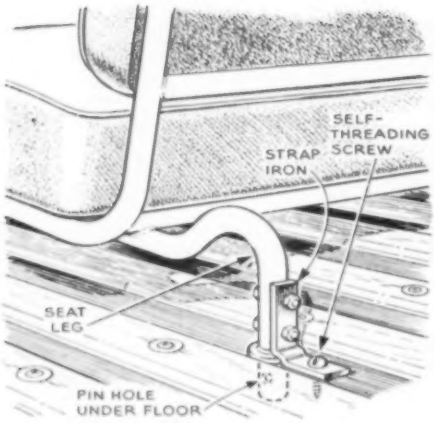
MORE Hints from the Model Garage



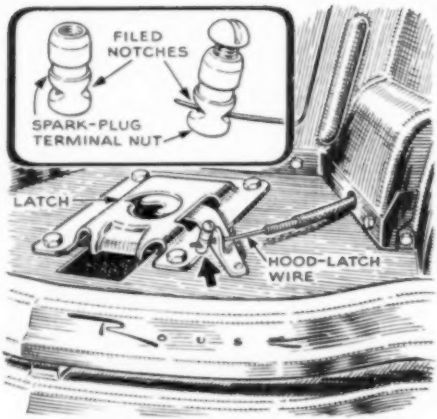
License Hinges on Tail Gate. On a pickup bought by the Modern Air Conditioning & Refrigeration Service, of Long Island City, N.Y., it was discovered that lowering the tail gate partially obstructed the tail light and license plate. A company mechanic solved the problem by mounting a hinge on the tail gate and bolting the light and license bracket to the hinge. This keeps light and license in full view.



Ready for a Good Deed. Driving a new car, you may tend to pass by motorists in need of a push because your shiny bumpers might get marred. John Calder, of Laurel, Md., prepared for this by cutting two 12″ lengths from a tire, trimming out the bead, and threading in a loop of wire. By hanging these on the bumper guards he can give (or receive) a push without damage to either vehicle.



Removing Station-Wagon Seat. To remove the middle seat from recent Ford station wagons, you must crawl under the vehicle and pull out a couple of pins. To make the job easier, Marion L. Rhodes, of Knightstown, Ind., bolted a strap-iron bracket to each seat leg as shown. Removing the screws frees the seat.



Repairing Hood Release. If the fitting gets lost from the end of a hood-release cable, James McElroy, of Kent, Ohio, suggests this fix. File notches in opposite sides of a spark-plug nut, pass the wire through, and clamp it with a small screw. The same idea might be used for choke and throttle controls.

This Table Cost Only $6.50

. . . because it was made out of breadboards and ax handles

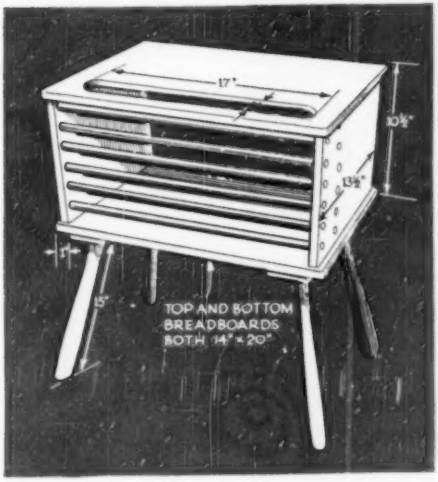


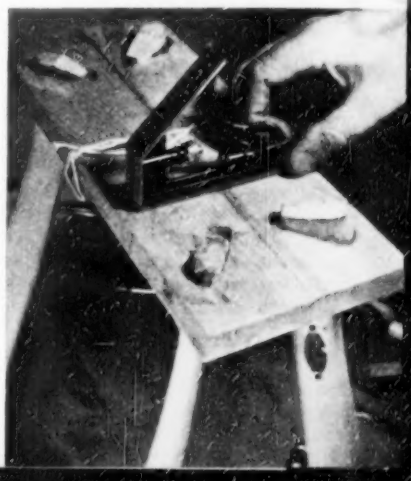
Table has space for books in front; magazines through slot at rear. You can also put a plant or small radio in book space and a lamp on top.

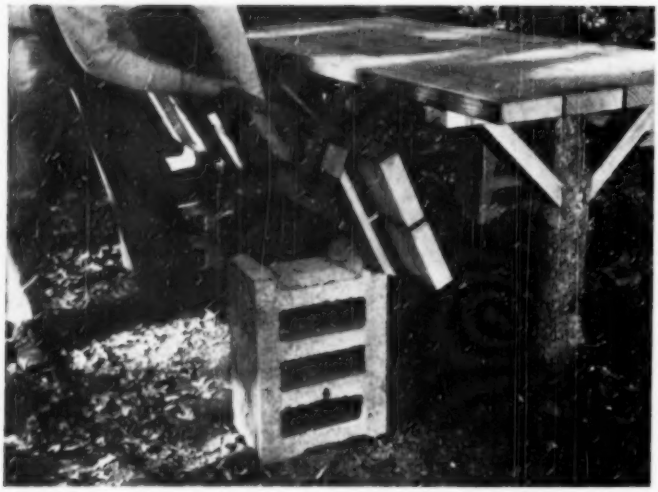
WIDE pieces of wood for small home projects are expensive and often hard to find—unless you look in a dime store. That's where I bought the two 14″ by 20″ breadboards that make the top and bottom of this table. Another breadboard was cut up to form the sides. With the exception of the two 3″ by 13″ cleats, all dimensions are on the drawing above.

Drill and file holes in the cleats to take the ax-handle legs. The legs are held by nails and glue. One photo shows a way to set the legs so they'll be level. If the slots you cut for the legs are too big in spots, fill the spaces with glue and composition wood.

The dowels at the rear of the table should be cut a little short. Then the ends can be covered with composition wood before sanding and staining. You should also stain the dowels before putting them in place.

After top section is assembled, cleats are nailed and glued to base as shown at left. Photo at right shows how to adjust legs. Nail and glue two legs to one cleat. Tie cleats together and put level on top. Then adjust the two un-nailed legs until bubble is in dead center. Then nail and glue them to the second cleat.





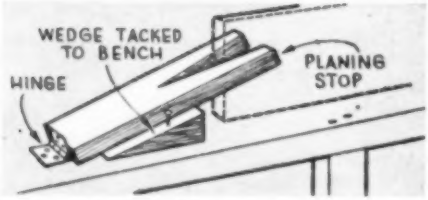
Tree Stumps Support Table

You can duplicate the sturdy picnic table and bench pictured at left by cutting down a couple of small trees in your yard or wood lot. The trees should be about five or six feet apart. Cut them so they'll be the right height for the table. Then use spikes to nail the planks and angle supports together. Upended concrete blocks support the benches.

Disk Heated to Apply Glue

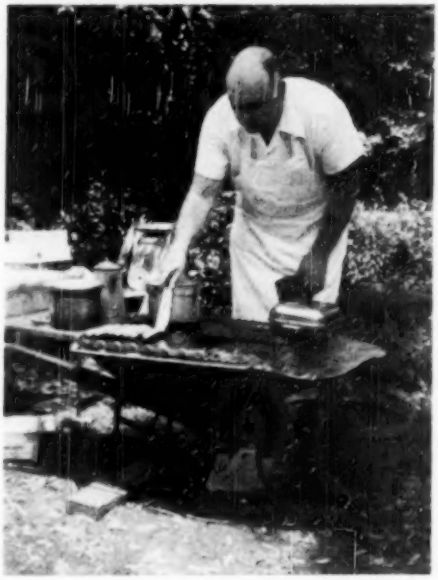
STICK-TYPE adhesive often is applied to a sanding disk by friction heat with the sander running. I had difficulty spreading the adhesive evenly, stopping the wheel, and placing the sandpaper before the glue chilled. Now I warm the disk over a stove, rub on glue, and place sandpaper on the disk. To clamp the paper and disk together while the glue is cooling, I place the disk paper-side-down on the drill-press table and lock the chuck down on it. *—E. F. Lindsley, North Prairie, Wis.*

Planing Stop Made Adjustable



TO MAKE a planing stop that's adjustable to boards of different width, notch a piece of lumber and hinge it to your workbench as shown above. Use a wedge cut from a two-by-four to hold the stop at the desired height.*—Victor H. Lamoy, Upper Jay, N. Y.*

Barrow Doubles as Stove



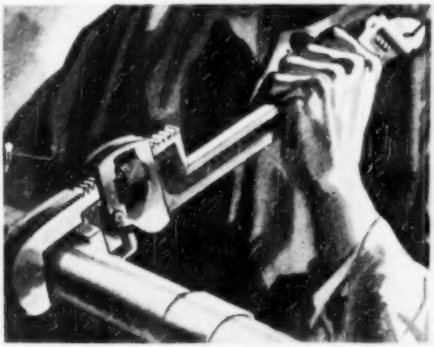
IN A PINCH, a steel-bodied wheelbarrow serves as a fine outdoor grill for back-yard picnics. Put the legs on a plank so the sides are level. Then bridge the top with an old oven or refrigerator shelf. A few boards, cleated together and mounted so they rest evenly across the wheelbarrow handles, make a handy work space. Kindle a fire in the body, add charcoal, and you're ready to cook.*—Ken Wright, Chappaqua, N. Y.*

I'd like to see them make . . .

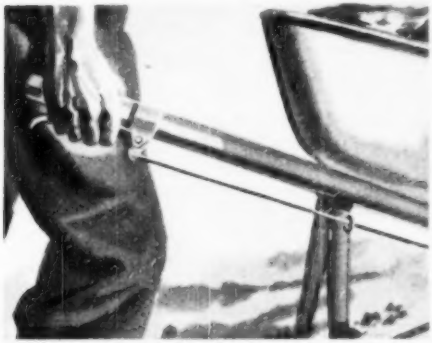
Everyone has his own pet idea of some gadget he would like to see in general use. What is YOURS? *Popular Science* will pay $5.00 for each one published. Use government postcards only. Contributions cannot be acknowledged or returned.

Coffee cans with pouring spouts. A vacuum-sealed pop-up spout built into the top of the can would make it easy to measure coffee. It would also eliminate handling of the sharp-edged lid.—*Mrs. J. Stanley, Bloomington, Ind.*

Plastic shoe coatings. If you could paint a hard, flexible plastic finish on new shoes, you'd be able to shine 'em up with a damp cloth. The coating could be colored or transparent.—*Mrs. George H. Smart, Cleveland, Ohio.*



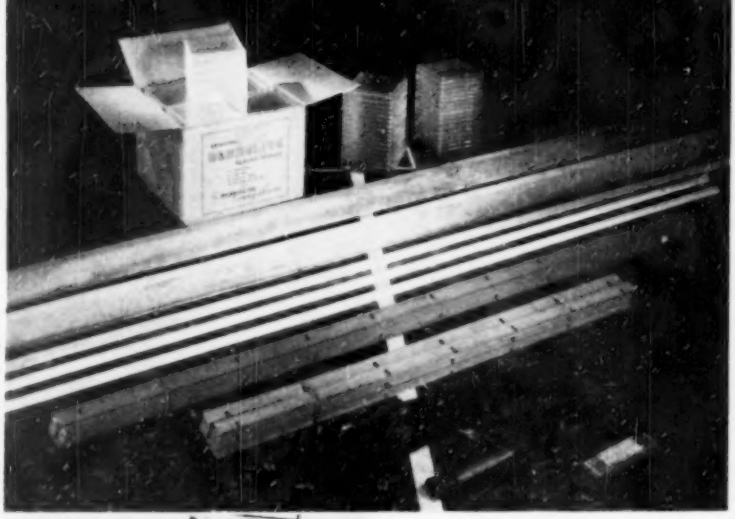
A double-ended pipe wrench. You need both a Stillson and an adjustable wrench when working on pipes and fittings. Having both on one handle would lighten your tool bag.—*Clarence Haeg, Plummer, Idaho.*



Wheelbarrows with brakes. A hand-grip brake would make it easier to handle loads going downhill. It would also keep the wheel from kicking back when the barrow is tipped for unloading.—*James A. Purington, Brunswick, Me.*

Rectangular dish pans. The old round pan wastes space because it doesn't fit either the dishes or the sink. Small feet on the bottom of the pan would keep it from blocking the drain. —*Mrs. O. J. Smith, Sedalia, Mo.*

All materials you need to build plastic-brick partition wall are shown at right. A ruler and three hand tools—hammer, saw, and square—are only tools needed. No cement or mortar is used. Two-by-fours and quarter-round molding are framing pieces. Notched strips form squares for plastic blocks.



Portable partition of plastic blocks screens dining area from kitchen in photo at left. Partitions can also be built permanently, as shown on the opposite page. Light weight is feature of these blocks. Each one weighs only slightly more than half a pound.

Plastic Bricks Make Partitions Easy to Build

IF YOU can use a hammer and saw, you can turn out a professional-looking partition wall with these new plastic blocks.

No mortar or adhesive is used. Grooved and notched basswood lattice strips interlock to form a framework of squares. Then the plastic plates, or half blocks, are pressed into the squares from both sides of the frame. Lugs on the sides of the blocks snap into the grooves in the lattice strips, locking the blocks in the squares.

The lightweight ⅝″ blocks are molded of polystyrene. They are 7¾″ square. Fitted into the frame of squares, they make a wall 2⅜″ thick. The lattice strips are ¼″ thick, 1½″ wide, and are notched at 8″ intervals.

The translucent partitions insure privacy yet provide 80-percent light transmission. You can get unusual effects in a partition by varying the direction of the ribbing on the blocks, by using internal lighting, by removing an occasional block and putting a small plant in the opening, or by enclosing figurines in some of the blocks.

Both blocks and lattice strips are products of the Bloxolite Co., of Pittsburgh, Pa. The blocks cost 90 cents apiece and the lattice strips 20 cents a running foot. A partition costs about $2 a square foot.

After determining height and width of partition, two-by-fours are cut to size and nailed. Either miter or butt joints can be used.

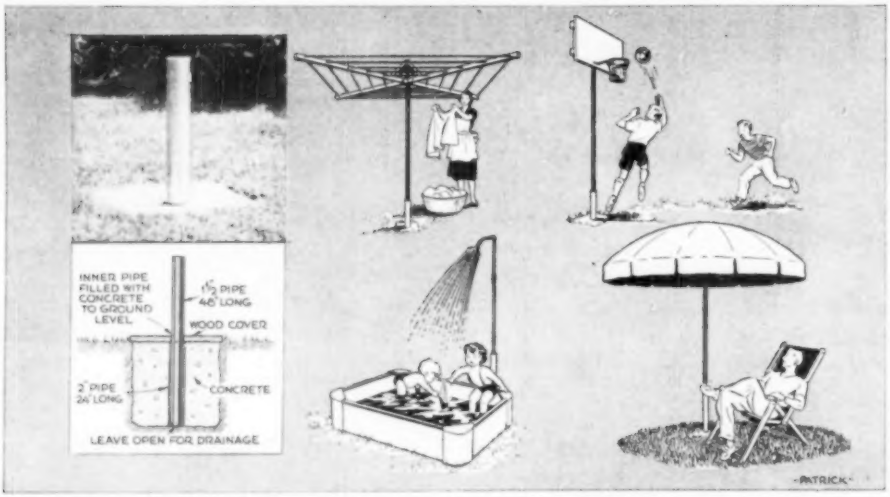
To allow for possible chipping or splintering of ends of lattice strips in shipping, they come longer than needed and must be sawed off.

Prenotched lattice strips are laid in position on floor. When assembled, the lattice unit looks like an oversize egg crate.

To hold lattice unit square and keep it from wobbling while being lifted into frame, a few rows of blocks are inserted on one side.

Quarter-round molding is nailed inside one side of two-by-four frame. Lattice unit is inserted (left) and quarter round is nailed on other side.

Last block is being fitted at right. This is maximum-size panel, but bigger openings can be covered by adding more 6-by-10 block panels.

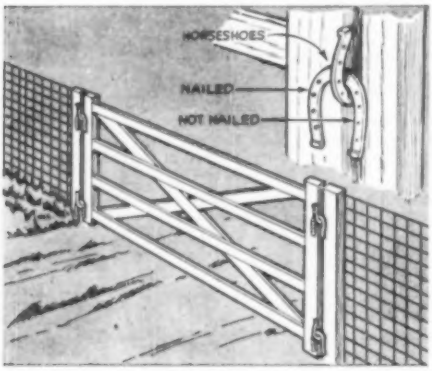


Pipe Holds Yard Equipment

We get more mileage from our yard since we sank into the ground a piece of pipe that can hold a variety of garden and play fixtures in turn.

I dug a hole 2′ deep, set in a length of 2″ pipe, and filled in around the pipe with concrete. A longer piece of 1½″ pipe fits inside this socket and acts as a support for an umbrella, clothesline, shower head, and bird bath. The removable inner pipe is filled with concrete to the level of the garden so that the fixtures will stand at their accustomed height.

A wooden cover around the concrete fill levels off the garden.—*Charles E. Crowe, La Crescenta, Calif.*



Fence Section Is Removable

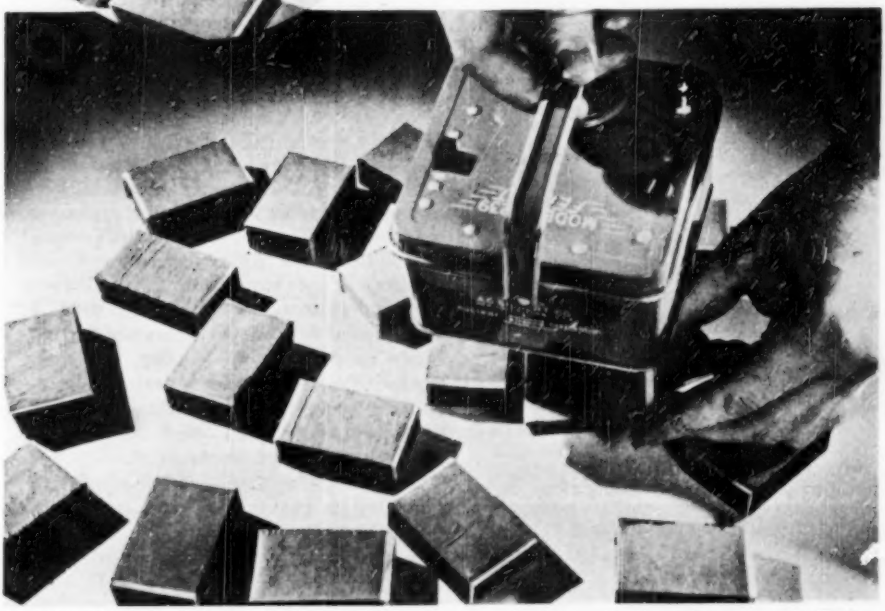
Occasionally it may be necessary to remove a section of fence. If such occasions are too infrequent to require a gate, you can build the removable section as shown here. Nail horseshoes to the section and to the posts at each end. The shoes on the section hook over those on the posts. Don't try to swing it wide without unhooking both ends.—*Victor H. Lamoy, Upper Jay, N. Y.*

Garden Chores Made Easy

The Little Farmer, shown in photo above, is a 1-horse cultivator that sells for less than $100. Designed especially for city and small farm gardens, it weighs about 100 pounds and is operated by a four-cycle, one-cylinder Briggs and Stratton gasoline engine. It is compact enough for stowage on its side on most automobile trunks. The single steel traction wheel, turned by a gear-and-belt drive, is loaded additionally by a removable 25-pound weight out in front. The Will-Burt Co., Orrville, Ohio, makes it.

Home Atom Labs Are Coming

By Kenneth M. Swezey
Author of After-Dinner Science



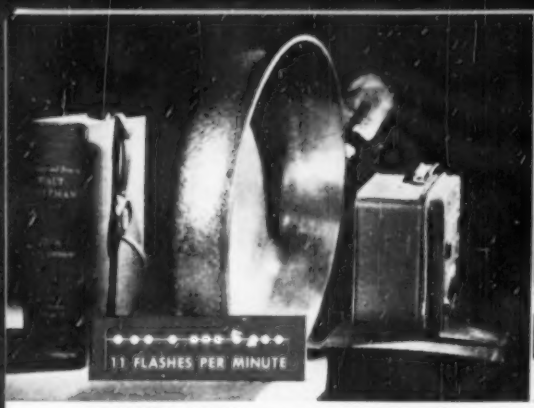
A radium-dial watch in one of the matchboxes shows how radioactive atoms act as tracers in research. No matter how boxes are shuffled, a Geiger counter will identify the "tagged" one.

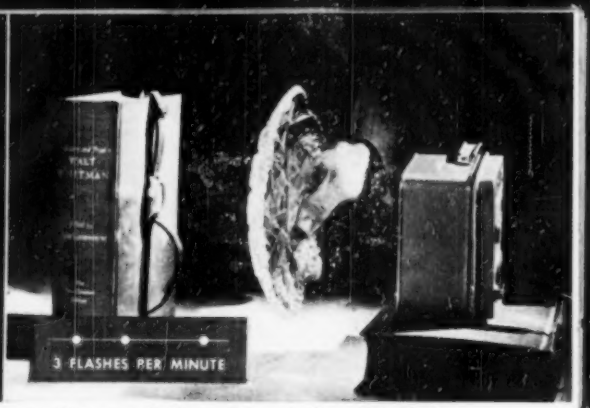
A NUCLEAR engineer of tomorrow may soon be watching the behavior of atoms on your kitchen table. Just as many modern chemists got started with toy chemistry sets, so today's youngsters will begin scientific careers with atom-lab toys that really work.

Your own ten-year-old may take a peek into his future in the murky ball of a midget Wilson cloud chamber, while you borrow his Geiger counter to go prospecting for uranium.

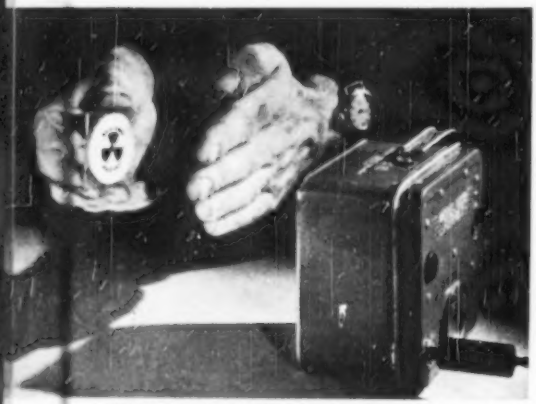
Up to now Geiger counters and other radiation detectors have cost real money. But research is bringing costs down. A Geiger counter you can build for less than $30 was described recently in POPULAR SCIENCE (March, 1950, p. 200). Inexpensive kits are now appearing on the market and ready-made counters are more widely available. Soon a toy maker will mass-produce a practical instrument that'll sell for $18.50, and a whole kit for experimenting with atomic radiations for $42.50.

To appear on the market this fall, the



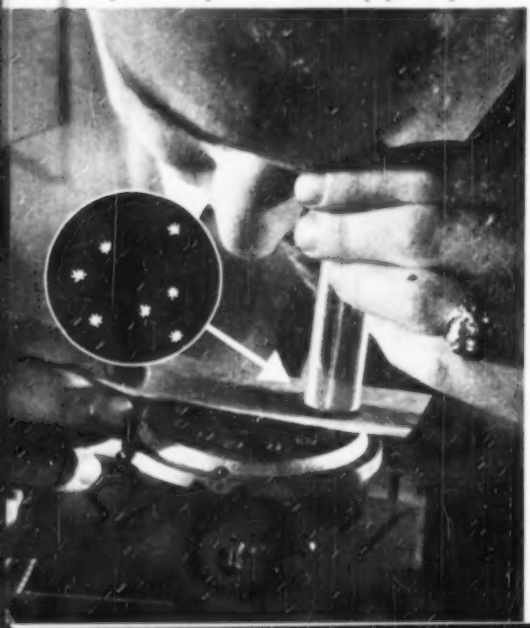


GAMMA RAYS, most penetrating of nuclear radiations, go through heavy aluminum skillet as if it weren't there. But cut-glass dish blocks them. Lead in the glass is effective shield.



BETA RAYS, high-velocity electrons, penetrate thin sheet metal but are stopped by a hand.

ALPHA RAYS cause scintillations on screen of spinthariscope. But sheet of paper stops them.



A. C. Gilbert Company's "Atomic Energy Lab" will include a Geiger counter, spectroscope, electroscope, Wilson cloud chamber, spinthariscope, radioactive standards and specimen ores, and materials for building atomic models. With it, any youngster—and his Dad—can actually do the experiments that led Becquerel, Crookes, Curie, and Rutherford into the atom. A preview of some of the stunts is shown on these pages.

If there's prospecting blood in you and you hunt in the right places, the Geiger counter might even help you discover uranium. If the ore is rich enough, the U. S. Government will pay you a bonus of $10,000 plus a guaranteed price per ton. "Prospecting for Uranium," a booklet prepared by the Atomic Energy Commission and the U. S. Geological Survey, and supplied with the kit, tells how to go about it.

The Geiger counter, resembling a small lunch box, is used to count beta and gamma rays. Every time such a ray hits the box, it goes right in, continues on through the shell of the Geiger tube, and momentarily ionizes the low-pressure gas there. This causes a neon tube to flash and a click to be heard in an earphone.

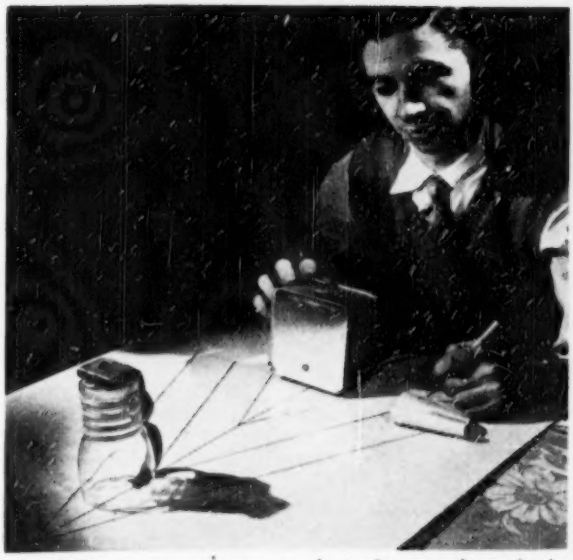
Before each test, radioactive materials should be removed from the vicinity and a count made of background radiation—the number of clicks heard when no known source of radiation is present. This background count must always be subtracted from the total. The flashes per minute in the tests shown in the photos are indicated by diagrams. Background flashes have been already deducted.

Two of the three main types of radiation from radioactive substances can be detected with the Geiger counter. Let's start with the

most penetrating—gamma rays. These aren't conventional particles but are electromagnetic waves similar to very short X rays, and travel at the speed of light.

You'd hardly expect ordinary light waves to penetrate the bottom of a heavy cast-aluminum skillet, but gamma rays from the radium dial of your watch go through it as if it were clear glass. Prove it by supporting the watch about 9" from the counter, taking a count, interposing the skillet, and taking another count. The second will be only a few flashes less than the first.

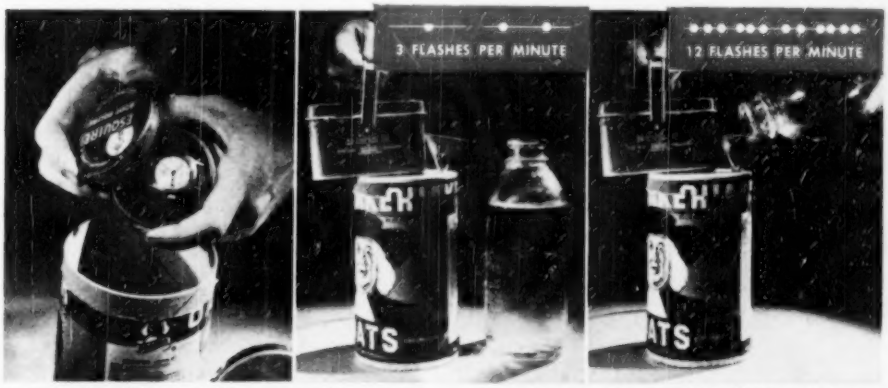
Oddly enough, a heavy cut-glass dish, which you can see through easily, may pass gamma radiations hardly at all. The glass contains lead, which is effective in cutting them off. That's why lead is used as shielding around dangerously radioactive materials.



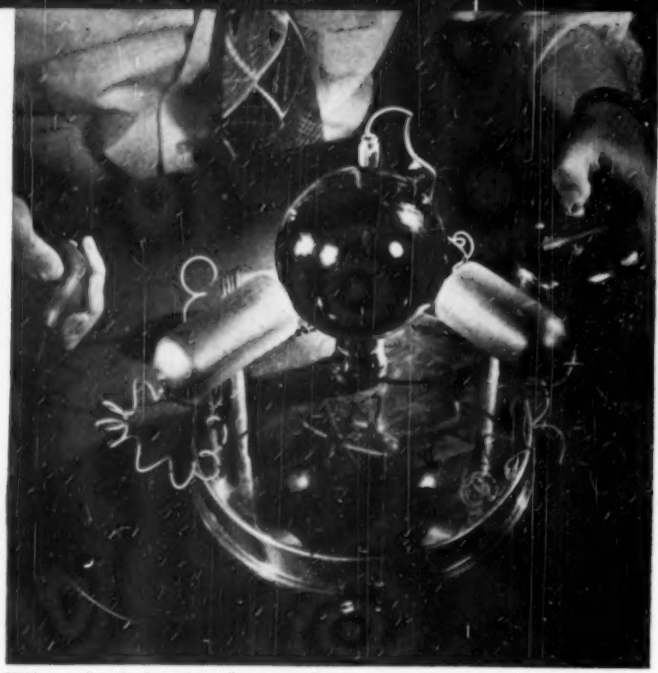
Like light waves, gamma rays diminish inversely with the square of the distance from the source. The count from a radium-dial watch at various distances proves it.

Beta rays, which are negatively charged particles traveling with speeds as high as 160,000 miles a second, can squeeze through a thin sheet of aluminum, but can't penetrate a quarter-inch of plastic or a half-inch of plywood. At atomic plants, safe shields against beta rays can therefore be made of transparent plastic. If rays that reach the Geiger counter are purely beta, they can be cut off by interposing your hand.

Alpha rays—heavy nuclei of helium atoms—can be stopped by even a thick sheet of paper. They consequently can't get through the tube wall to affect a Geiger counter at all. But let them fall on the zinc sulphide screen of a spinthariscope—the little black tube shown at the bottom of the facing page—and they put on a spectacular show. Shot



Atomic liquid-level indicator can be demonstrated with this setup. Radium-dial watch in watertight float is put into empty, waterproofed carton. As water is poured in, flashes of Geiger counter increase according to inverse-square law. Height of water can thus be calculated.



Wilson cloud chamber dramatically traces path of alpha and beta particles by droplets of condensed vapor. Gamma rays, which are not traveling particles, show up as irregular jiggles.

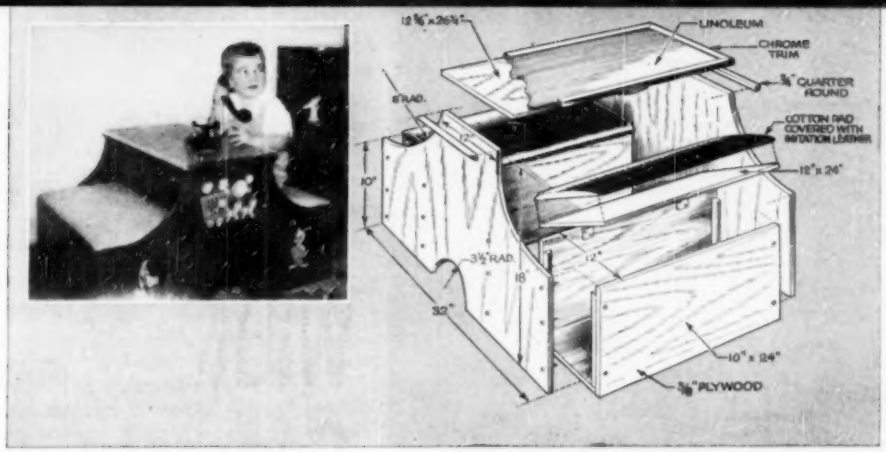
out at a rate of 10,000 miles a second by an exploding atom, each alpha particle hits the screen with such tremendous impact that it creates a flash of light.

All three rays diminish inversely with the square of the distance from the source, the same as light. You can test this principle best with gamma, because these rays go farthest and do not deviate from their course. If you support a radium-dial watch 6 inches from the counter and take a reading, and move it to 12 inches away and take another, you'll get about four times as many flashes or clicks at the first setting as at the second.

You can play prospector by using Geiger counter to locate radioactive objects under board.

This principle is used industrially to determine the level of liquids in opaque, closed containers. A radioactive substance is placed on a float. The rise or fall of a liquid can be calculated by reading a counter at the top of the container.

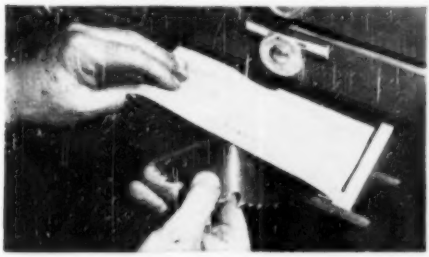
Any physicist will tell you that the Wilson cloud chamber is one of the most entertaining gadgets in his lab. There's a cloud chamber in the Gilbert set. One of the oldest tools of the atomic physicist and still one of the most useful, it gives a startling visual demonstration of the effects of atomic radiations in action. Rays are caused to streak through supersaturated vapor above the surface of an ink-colored mixture of alcohol and water. As the rays plough through the vapor they ionize air molecules in their path. Vapor condenses on these molecules, forming a telltale cloud track that traces the radiation's course. END



Combination Toybox-Table Set Saves Space

Our little boy needed a toybox and a table-and-chair set. Since we had to watch space as well as dollars, we built the inexpensive combination illustrated above. We used ⅜" plywood; ¼" stock might do but would be a bit light. The table top is covered with linoleum and edged with chrome trim. Seats are topped with a layer of cotton batting and covered with waterproof imitation leather.

The finished piece can be enameled or stained and varnished. Nursery decals will help brighten the appearance.—*Claud C. Hurd, Columbus, Ohio.*



Saw Blades Stored Compactly

Extra circular-saw blades kept on pegs or nails take up a lot of wall-rack space and can be hazardous. You can store them safely and compactly in a shallow drawer. Protect the teeth by slipping each blade into a Manila envelope—the heavy brown-paper kind. Cut off the flap ends, and mark the saw type on the outside of each envelope. —*Will Thomas, Kenmore, N. Y.*

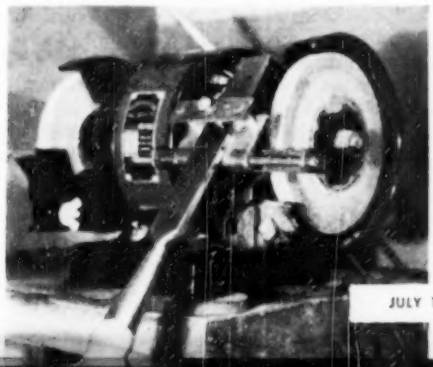
Hollow-Grinding Fixture

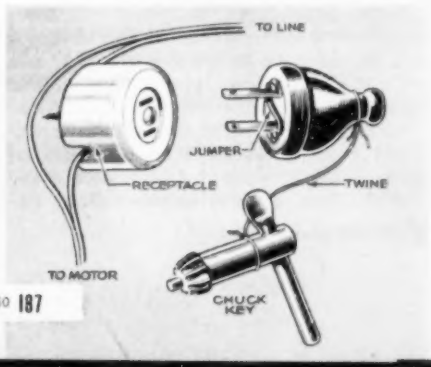
Chisels and plane irons can be accurately hollow-ground on an ordinary wheel with the help of the fixture shown below. It's made from a hinge that slides on a ¼" rod. The rod is mounted on a U bracket that clamps to the regular tool rest.

A strap is riveted across the hinge with ¼" spacers between. A bolt turned into a threaded hole in the strap secures the tool to be ground.—*E. N. Horr, Cleveland, Ohio.*

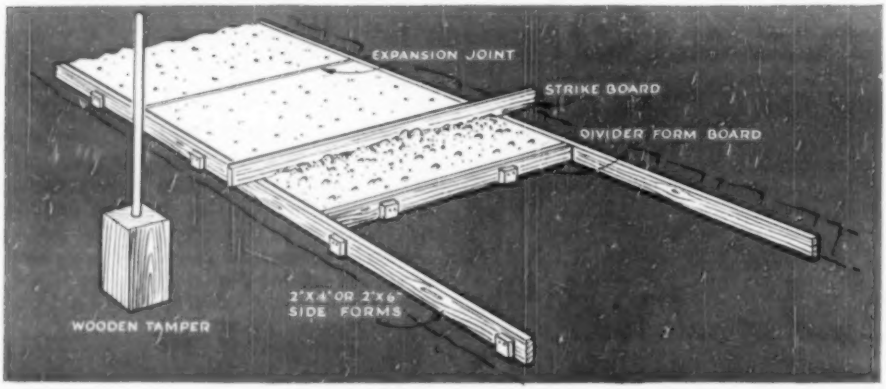
Plug Pulls Drill-Chuck Key

If you've ever forgotten to remove the chuck key before starting your drill press, you know that the key may be slung with wicked force. After one close call I wired a receptacle in series with the motor, shorted a plug with a jumper, and tied the chuck key to the plug. Now I can't start my drill press unless the plug is in the receptacle, so the key has to be out of the chuck.—*Martin Berman, Cincinnati, Ohio.*





Improve Your Home With Concrete



SIDEWALKS

WALKS are usually 4" to 6" thick. If used only as a walk, 4" is enough. If cars will drive over a walk, it should be 6" thick.

Concrete can be poured directly on the ground if the soil is well drained. If it's not in a location where drainage is good, a 6" layer of coarse gravel or cinders should be laid down. In any case, use a tamper.

Two-by-fours held in place by stakes usually are used as forms. For drainage, a walk should slope to one side about ¼" per foot. Place one side of the two-by-four forms higher than the other to get a slope.

In building a walk or driveway, you should provide contraction and expansion joints. Place 1" thick divider boards every 4' to 6'. Pour concrete in every other section. When these sections are hard enough to be self-sustaining, remove the divider boards. When concrete is poured in the remaining sections, the slabs will be sufficiently separated.

A walk can be poured continuously—without waiting for every other section to harden—if you place strips of tarred felt against each divider board. Pour concrete on both sides of the divider boards. Then pull out the dividers. The felt, made for the purpose and sold in most supply yards, stays permanently between the slabs.

As you pour the concrete, level it off with a strikeboard resting across the forms. Pass the strikeboard across the concrete with a sawlike motion. Several hours after the concrete is poured, finish it with a wood float to produce a smoother surface.

WHETHER you live in a small home or a big house, have an average yard or a broad lawn, you'll find concrete can make useful and decorative additions.

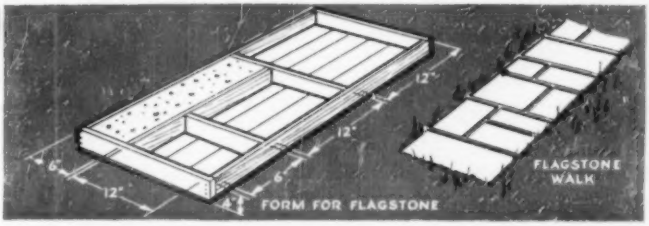
Maybe you've never tried working with concrete. It's not too difficult. Follow the rules and start with some simple project—like making a flagstone walk. You'll have the hang of it before you finish the job.

The tools you need are simple—trowels, measuring equipment, shovel, hoe, pail, and a mixing platform. The mixing platform should be watertight so you won't lose water through it during mixing. And make the platform roomy enough to work on.

Accurate measurement of all materials—including water—is important. For water, you can mark the inside of a pail at different heights to indicate quarts and gallons. The easiest way to measure sand and pebbles is in a bottomless box. Build the box with these inside measurements: 1′ deep by 2′ square. Inside the box draw lines 3″, 6″, and 9″ from the bottom. When the box is filled to the 3″ level with sand or pebbles, you have 1 cu. ft. The second level gives you 2 cu. ft.; the third, 3 cu. ft.; and filled to the top you get 4 cu. ft.

Of course, you need lumber for forms. Concrete is heavy—from 130 lb. to 150 lb. per cu. ft. So be sure to build the forms strong enough and use plenty of bracing. Before pouring concrete, it's a good idea to oil the forms. This makes removing them easy. Use a rag or old paintbrush and smear the inside of the forms with old crankcase oil. Another oiling mixture is equal parts of boiled linseed oil and kerosene.

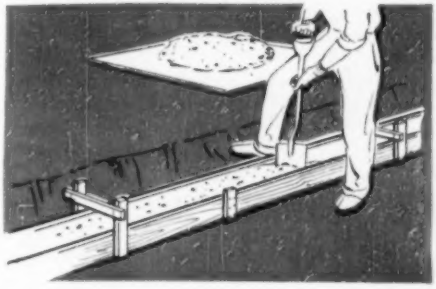
FLAGSTONE WALKS



A SIMPLE form for casting concrete flagstones is shown at the right. You can vary this design to suit yourself, even making triangular stones. Or, you can dig irregular holes in the ground where the walk is to be and pour the concrete into the holes, smoothing it off with a wooden float.

If you use a wooden form for your flagstones, assemble it with screws so it can be taken apart easily. You'll probably want to use it more than once. And oil the boards before each use. Mineral pigments often are mixed with concrete to make the flagstones of different shades.

LAWN CURBING



You can give your front yard a neat appearance—and at the same time stop soil erosion—by bordering it with low concrete retaining walls.

Dig down to a solid footing for the curbs and, if you live in a severe climate, carry the curb down below the frost line. You can use the sides of the excavation as a form if the earth is firm. If not, you'll have to put in forms to the bottom of the excavation. Build the wall at least 6″ thick.

Be sure your forms are rigid and brace them well so they'll withstand the pressure of the wet concrete. Then you'll have a straight wall—one without bulges. To keep the sides of the forms evenly spaced, tie them together with spreaders. To obtain smooth sides, thoroughly spade the concrete next to the forms. The top of the curb can be finished flat or round. Mineral pigments may be added to give the curb a color harmonizing with your house. And don't forget to oil the forms.

STEPS

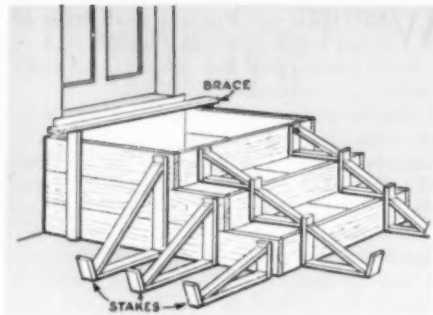
STAIRS probably receive more wear than any other part of your home. Concrete steps are fairly simple to build, easy to keep clean, and they won't rot or sag.

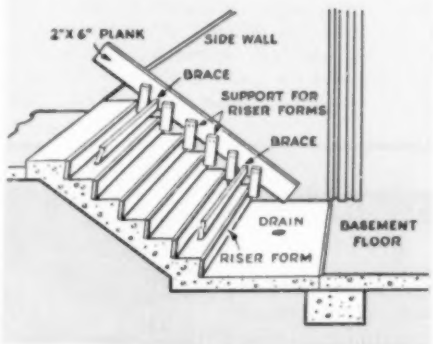
Be sure to make the rise of your steps low enough and the tread wide enough for safety and comfort. A good rise is 7½" and a tread 10". Build the forms of 1" or 2" lumber—2" stock is better—and brace them well so they won't bulge.

Some of the space inside the form of outdoor steps can be filled with rocks. Pour in some concrete, drop in rocks, pour more concrete, and top it off with a 6" layer of concrete. Using rocks will take up some of the space and save on concrete.

Pour concrete to the level of the first step. Then spade and compact it. Pour the next step and spade it. Continue until you've poured all the steps. Let the concrete set and then use a wooden float to finish the steps. This will leave a smooth but slightly gritty non-skid surface.

If small basement steps are placed on compacted ground or cinders, you don't need to reinforce them. But use metal reinforcing rods on wide or high stairs.





POOLS

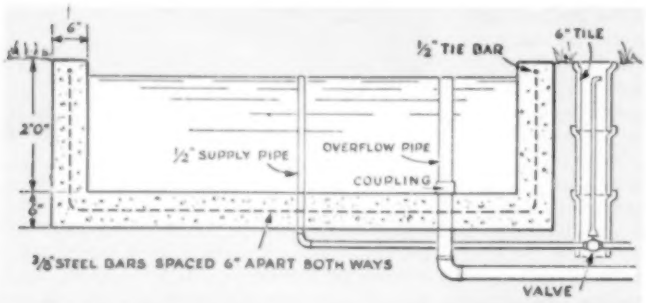
A POOL dresses up any back yard—even a small one. You have a wide choice of sizes and shapes of pools. A design for a simple but attractive one is shown below.

First step is excavating for the pool. No outside form is needed if the soil is firm and well compacted. If the soil is loose, both inside and outside forms are needed. Use 20-gauge galvanized iron as a form where you want to curve the sides or ends. Reinforcements must be used. Place supports across the top of the excavation to hold the interior form 6" off the bottom of the pit.

You can fill the pool with a garden hose and empty it by siphoning, but plumbing connections are more desirable. Install all pipes before pouring concrete. In this pool, the overflow pipe also serves as a drain when you unscrew it at the coupling.

Pour the concrete for the floor and sides in one operation. Then there will be no joints and less chance of leakage. Pour about 6" or 8" of concrete at a time in the wall form. Spade and tamp it before pouring more.

Water in new pools may be alkaline—enough so that it may kill fish. First test the water with pink litmus paper that you can buy at a drugstore. If the paper turns blue when placed in the water, it's not safe for fish. Change the water weekly until the paper remains pink. Then the pool is safe for fish.

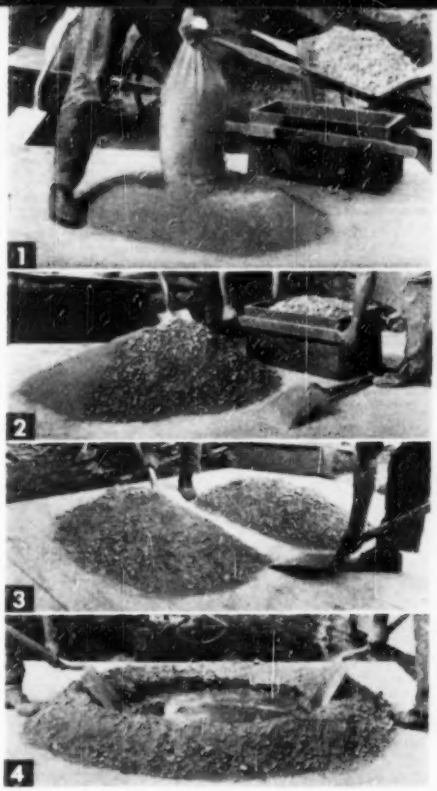


MIXING AND CURING CONCRETE

THE watertightness, strength, and durability of concrete depend on the proper proportion of water to cement. The table at the bottom of this page gives you mixtures recommended by the Portland Cement Association. It's a good idea to mix a trial batch first. You may find that the trial mix is too wet or too stiff to be workable. To correct a too-wet or too-stiff mixture, don't change the proportion of water to cement. Change the proportion of sand and pebbles. Cut down on the sand and pebbles if the mixture is too stiff. If it's too wet, add sand and pebbles slowly until you get a workable mixture. Concrete should be poured into the forms within 30 minutes after mixing.

A workable mixture has two requirements: it should pour readily and it should give you a dense concrete after spading and tamping. Each grain of sand should be coated with cement and each pebble coated with the sand-cement mortar. Spading concrete as it is poured is important. This forces the coarse pebbles away from the form. Then you'll have a smooth surface.

New concrete should not be permitted to dry out for a week or ten days. If concrete dries too quickly it does not harden properly and loses strength. Walks, steps, and pools can be covered with straw or earth and kept moist by sprinkling with a garden hose. Lawn curbings and walls can be covered with sacks or canvas and kept wet.

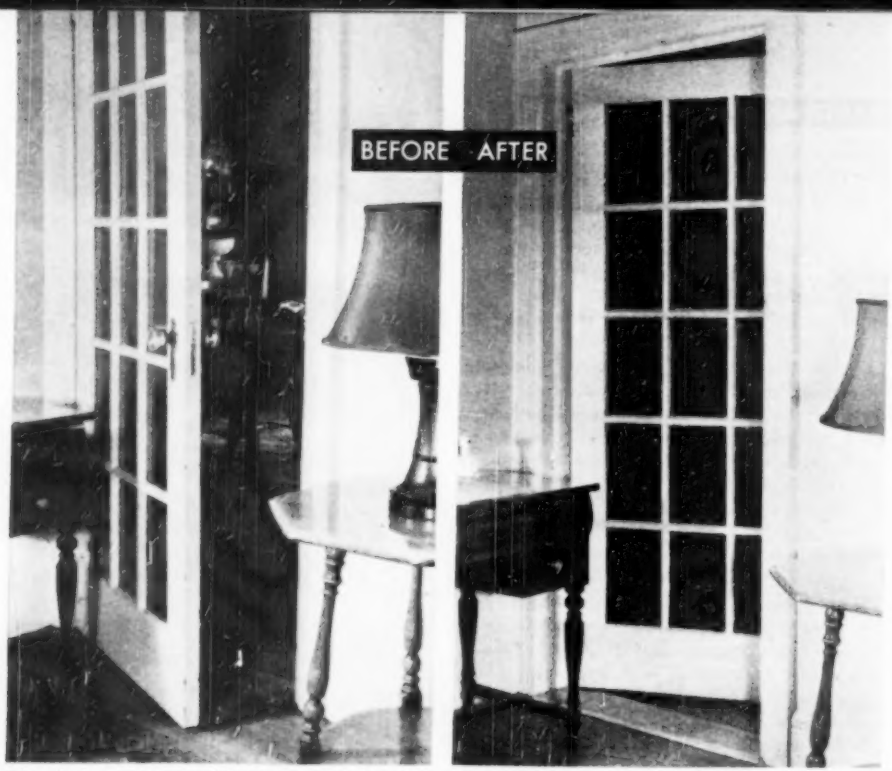


Steps in mixing concrete: 1. Measured amount of sand is spread out and cement added. This is thoroughly mixed. 2. Required amount of pebbles is added. 3. Mixing continues until pebbles are evenly distributed. 4. Then correct amount of water is added and mixed in.

CONCRETE MIXTURES

Kind of Job	Wet Sand	Wet Pebbles	Sacks of Cement	Gal. of Water
	cu. ft.	cu. ft.		
Foundations, footings, and walls that need not be watertight, lawn curbs.	2¾	4	1	5½
Watertight walls and walls above ground. Sidewalks, pools, steps, driveways, basement floors, porch floors, cisterns.	2¼	3	1	5
Fence posts, flower boxes, benches, bird baths, work of very thin sections.	1¾	2	1	4

FOR YOUR POPULAR SCIENCE INFORMATION FILE



This desk was jammed behind a glass door because there was no other space. It didn't let the door open fully, and threatened the glass.

Rehung this way, door has ample swing space and there is enough room to walk by the desk. Door lock and hinges had to be swapped about.

How to Turn a Door Around

By Harry Walton

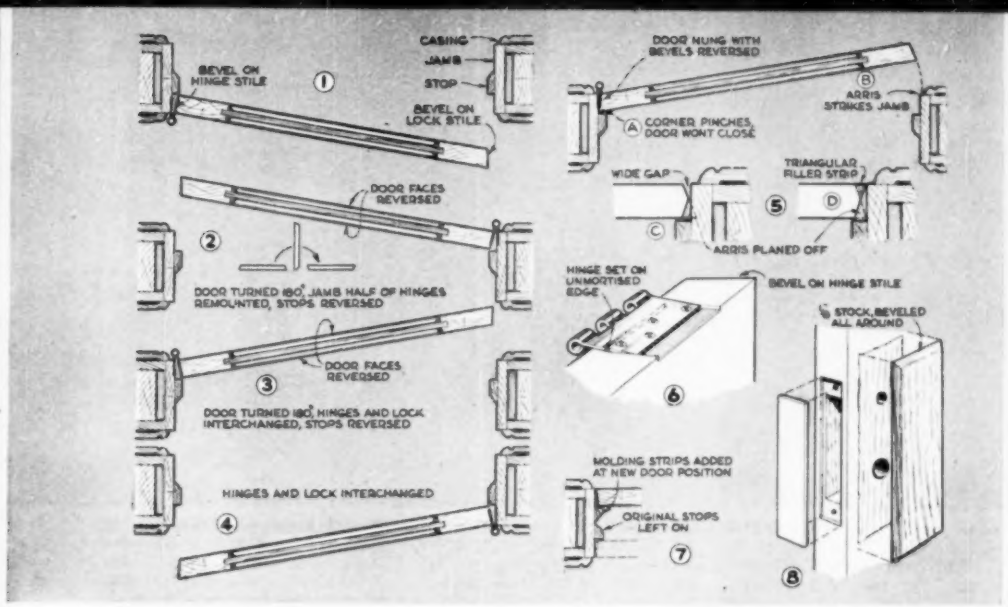
ANY door that can't be opened freely, without banging furniture or tangling with another door, is a candidate for rehanging. When a television set just has to go into a certain corner, a longer sofa replaces a short one, or a refrigerator is squeezed into a spot where its opened door hits a kitchen door, rehanging may be the solution.

But don't rush for the screwdriver just yet. There are only four ways to hang a door—assuming you don't invert it, which is rarely possible—and the other three may all be worse than the way it is now. Do you want it to swing into the same room, or the adjoining one, and from which jamb? Are the two door faces different in finish?

By studying Figs. 1 to 4, you'll soon know whether your door can be rehung to advantage. Two of the changes shown (Figs. 2 and 3) turn the door completely around. If one side is oak and the other off white, it will be a tough chore to refinish them.

If a door could simply be pushed from one side of the jamb to the other without turning it around, the change from Fig. 1 to Fig. 2 or 3 could be made without reversing the faces. But as the lock stile is beveled for clearance, the bevel would slope the wrong way, and the arris would strike the jamb, as at A in Fig. 5. Planing it off to fit would leave a wide gap, as at B. A filler strip could be fitted to close this, as shown at C.

Before deciding on such a compromise, better check the hinge stile. It's often beveled too, and if so, reversing the hinges



First step is to tap out the hinge pins, bottom one first, with door closed. Carefully lift door off the hinges with both hands, and set it aside in a safe place while you work on the casing.

If saddle is to be replaced, lift it with chisel enough to raise nails; then pull them. Stop strips on jambs went to the floor here. If yours fit over saddle, remove them first.

will bind the door as at D, Fig. 5. One way out is to set the hinge leaves in the old mortises, but on top of the unmortised strip as in Fig. 6. You may need slightly longer screws and, incidentally, the leaves that were on the jamb will now go on the door.

Mounting the hinges this way will widen the hinge gap. It may be neater to plane the hinge bevel completely off, building up the lock stile with a filler strip. (New doors are fitted with 1/16" clearance all around.) These methods are compromises, but may serve if you want to avoid refinishing.

If the door can be turned about, the switch from Fig. 1 to Fig. 2 is easiest of all. The hinges are taken off at the jamb only, new mortises are cut in the other jamb, stops are reversed, and the lock strike remounted. But to rehang the door as in Figs. 3 and 4, the hinges must be remounted on the lock stile and the lock on the hinge stile.

When a door is rehung from the other side of the jamb, as in Figs. 2 and 3, the standard saddle or sill won't be under it. If you aren't fussy about looks or underdoor drafts, you can simply put up with the gap under the door. Often it's not practical to

Drive chisel between jamb and stop to open joint. Pry cautiously, chisel bevel down, full length of strip. If nails pull through, draw them afterward. Sand off paint feathers.

If stops reach to floor, cut off ⅜". Turn top one, swap others, and nail back temporarily. Locate them as far from the new hinge edge as they were from the old.

Pencil hinge locations on old lock stile. Stand door in opening on old saddle, with chisels beneath to raise it within 1/16" of top. Stab both stile and jamb with knife to mark mortises.

move the old saddle to the other side, for the floor surface left bare when you shift it won't match the rest of the floor, and may show a gap. The neat answer is an extra-wide saddle.

To get the width of the new saddle, measure across the jamb to the outside of both casings and add 1". Any mill can make a saddle for you, or you can plane two wide bevels on a ⅜" plank yourself. If the stops—those strips on the jamb against which the door strikes—go right down to the floor, the saddle will have to be notched around them. It's easier to cut the stops ⅜" shorter and fit the saddle under them.

The stops can be carefully pried off, interchanged, and nailed back on in the reversed position shown in Figs. 2 and 3. However, if you don't plan to install a new saddle under the door, you can leave the stops on and nail on narrow strips of molding for the new door position, as in Fig. 7.

To remount hinges on the jamb only (Fig. 2), rest the door on the old or new saddle, with chisels or wedges beneath, and mark the jamb mortises from the hinges on the door. In moving hinges to the other stile, mark stile and jamb simultaneously with a knife.

Should you chisel a hinge mortise too

New saddle should be 1" wider than distance across casing, and same length as old. With door off, scribe across jambs as shown. Mark jamb width. Cut corners to fit around casing.

At least one stop will have to be removed to put the saddle down. Fasten it with finishing nails. Then nail both stops on permanently. Set all nails well below the surface.

Close the old hinge mortises in both door and jamb with thin pieces of wood cut to fit. Fill crevices and nail holes with putty or composition wood. Sand and repaint the jambs.

Gauge mortises same width as old ones on both door and jamb. Cut tops and bottoms with a back saw as shown, or with chisel cuts. Since chisel crushes wood, start slightly inside lines.

Start cutting mortises with crosswise chisel cuts about ⅜" apart. Clean out with chisel held lower, its bevel down. Use half of hinge to test the mortise for depth and flatness.

Mount jamb halves of hinges with one screw each. Hang door, tapping hinges into alignment if necessary. Locate any binding point with paper as shown. Plane stile or fit shims to correct.

deep, put a cardboard shim under the leaf. If the mortise slopes because you've cut too deeply on one side or the other, a narrow strip of cardboard under the low side will remedy things. Run a strip of paper down the crack between stile and jamb to find just where a door is binding.

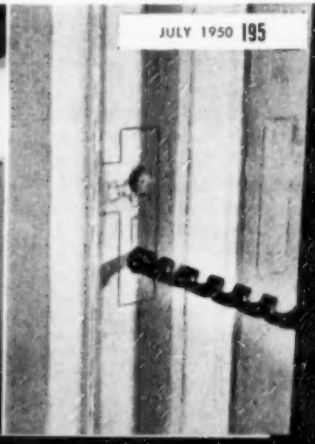
Thin pieces of wood, the same thickness as the hinges, do a neater job of closing old mortises than putty or other filler. Glue or brad them in. Similar pieces will close the old lock mortise on the door and the strike-plate mortise in the jamb. A similar thin panel can be used to conceal the area uncovered by removing the lock escutcheons (Fig. 8). If you're going to refinish the door anyway, you can plug the lock holes with a dowel instead.

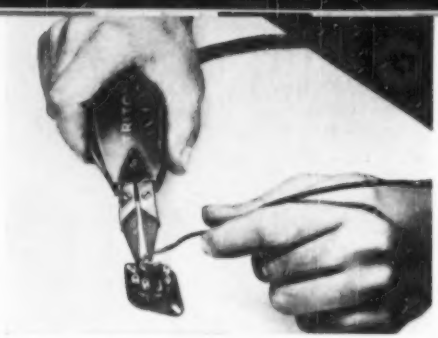
To reverse a common door lock, remove the single screw holding the cover plate. The latch bolt can then be lifted out (take care not to lose the spring) and flipped over so that its bevel will match the new position of the strike plate, which is simply turned over. The door stile is mortised for the lock by boring in from the edge and chiseling out. Bore from the face for the spindle and key. If this is too much of a chore, you can buy a new latch of the type that requires only two holes for installation. END

Remove knobs, spindle, and two screws in edge of door. Pull lock out of mortise. Take out screw holding cover plate, and flip over the latch bolt (arrow) to reverse the striking bevel.

Close lock mortise with thin wood. After removing lock escutcheons, plug the round holes with dowel or cover the entire area with a thin wood panel or sheet metal, painted to match.

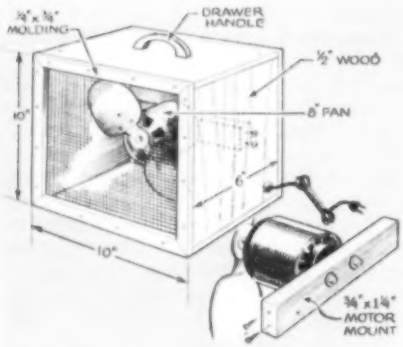
Turn strike plate over to reverse it, and mark out mortise through it. Bore overlapping holes; then chisel square and cut shallow plate mortise. Close old mortise as at right.





Pliers Solder Joint Fast

THIS new soldering tool grips parts to be joined, applies heat, and then holds the joint firmly till it's cool. Two carbon jaws grip the work and a pressure switch in the handle turns current on and off. The carbons, connected to a low-voltage transformer, heat up instantly, so an average job can be done in two seconds. The device draws 250 watts while heating, but only 1 watt on stand-by. The Housing Foundation, Inc., New London, Conn., sells it, complete with transformer, for $22.50.



Fan Made Safe for Children

TO SAFEGUARD our small children, I took our 8" electric fan off its base and boxed it as shown. The case has ¼" mesh hardware cloth on the front and back. For mounting the motor, I took out two long bolts that run through the end bells and substituted still longer ones.

The unit can be used as a window ventilator by placing it on the sill, or as a heat circulator between two rooms in the winter by hanging it in a transom. It's also an ideal fan to carry in the car in warm weather for overnight use on tours, as the blades can't be damaged.—*Marion L. Rhodes, Knightstown, Ind.*

TV Antenna Mast Jacks Up

A TELESCOPING antenna tower that can be adjusted in height from 20 to 47 feet may simplify TV installations in some fringe areas. The "Jack-Up" tower, made by Camburn Sales & Mfg. Corp., Battle Creek, Mich., is built in three sections and has a jack on top of the lower section that raises the other two. The jack and a release handle can be operated from the ground by cables. The tower can be installed on a roof or placed directly on the ground. It retails for about $60.

Truck Previews TV Antenna

THIS mobile, truck-mounted antenna gives customers a chance to look before they buy. The truck, containing a 70-foot telescoping mast, is used by Channel Master Corp., of Ellenville, N. Y., to demonstrate its antennas. Often several installations have to be tried in fringe areas before a suitable one is found. The mobile unit makes the tryouts inexpensive.

Your Pocket Can House a 4-tube Radio

Homemade midget superhet will bring in everything on the dial.

By Albert Rowley

YOU don't have to carry your portable radio this summer—you can *wear* it. Here's a homemade receiver that is just about the last word in midgets. It's so small you can slip it into your shirt or trouser pocket and hardly know you have it with you.

You might think that so tiny a set has to be a slipshod, one-tube imitation of a real radio. Not this one. It is a four-tube superheterodyne that will pick up everything on the dial. Headphones reproduce the sound with good tone, fidelity, and volume. Inch for inch and ounce for ounce, this is a good bet in portables.

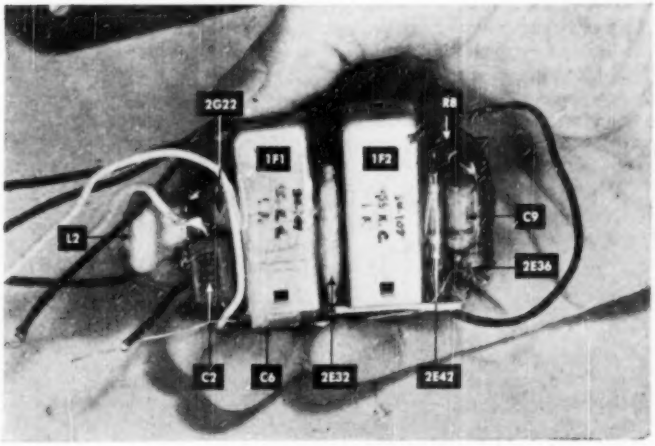
If you've had a little practice in radio building, you can make yourself a midget receiver just like it. The job does present some rigid space limitations, so it is important that you work carefully and systematically. The first step is to collect all the parts, including the cabinet. Then plan the complete arrangement, and drill all mounting and trimmer-adjustment holes before you solder a single wire.

It's light as well as small. Complete with batteries, the set weighs less than 14 ounces.

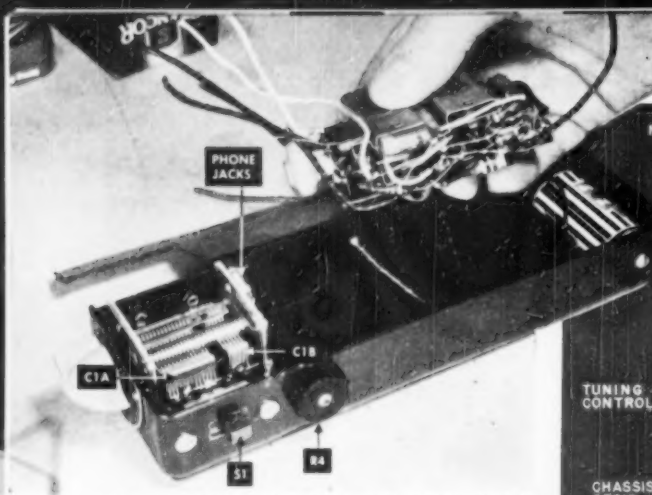
Cabinet: Since the cabinet may determine the arrangement, let's talk about it first. The one shown was made from a plastic dressing-table tray that came from the dime store. It's the kind women use to keep make-up articles separated. Compartments are molded right into the plastic. One three-section strip was sawed off and left-over pieces were used for a cover and mounting strip.

The three tray compartments are perfectly suited to the three-part construction of the receiver. Even if you decide to modify the cabinet you will find it easier to build this set if you work on it by sections.

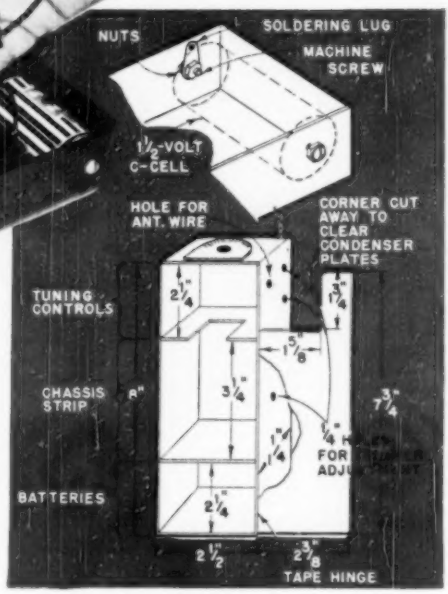
Section 1—Controls: The top compartment contains the parts that tune and



Tubes are attached to the IF transformers with cellulose tape. Make sure that the prongs clear the sides of the cans. Transformer shield cans must be grounded.



The oscillator coil, at the end of the chassis strip, extends into the top compartment. The wall between is cut away to make room for it.



adjust the receiver. They are shown by solid color lines in the diagram. A two-gang variable condenser (C1) is placed so that its tuning shaft protrudes through the top of the cabinet. When the plates are in mesh, the unit fits nicely in the 1¾" cabinet depth. To make room for the plates to swing through the entire tuning range, however, it was necessary to cut away one corner of the cover as shown in the cabinet drawing.

Other parts located in the tuning section are the on-off slide switch, two phone jacks, volume control (R4), and the homemade antenna coil (L1). The volume control is an extremely compact unit made for hearing aids. Its variable-resistor element is enclosed in the knob, so only the three connecting lugs actually go inside the box.

The antenna coil is the only non-standard part in the receiver. To get one small enough, you may have to make it yourself. For the core, use the powdered-iron slug from a standard iron-core antenna coil. Examine any burned-out coils you may have in your junk box, and try to find a slug of the dimensions shown in the sketch.

Wind 125 turns of No. 34 D.C.C. wire around this core. Fit the finished coil between the slide switch and the variable condenser.

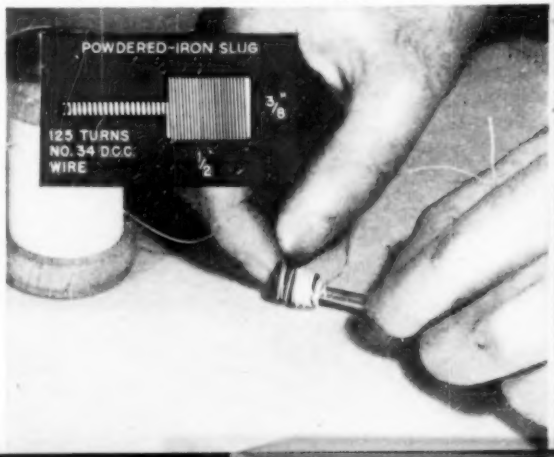
Section 2—Chassis Strip: All the tubes and most of the small parts are assembled on a plastic strip that fits into the center compartment. The IF transformers, attached to the strip with self-tapping screws, serve as anchors for the peanut tubes. The 2G22 and 2E32 are taped to the left and right, respectively, of IF1. The 2E42 goes on the right side of IF2.

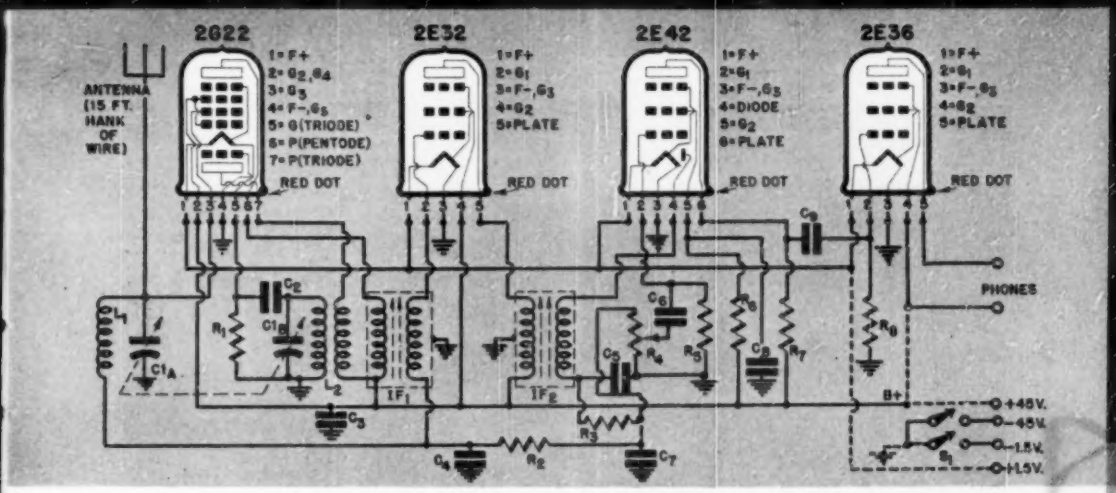
The two other major parts of the chassis strip, the 2E36 output tube and the unshielded oscillator coil, L2, are mounted directly to the plastic.

A small, pencil-size soldering iron will be a big help in wiring the tighter corners. If you don't have one, use a sharp tip in your regular iron. Take it easy with the solder. Some of the connections—especially to tube prongs—are so closely spaced that even a small solder blob may short them out.

Wire all necessary parts and leads to the 2E42, and then go on to the 2E36, the

Wind the antenna coil on a powdered-iron core. Make the windings flat, and seal the coil with dope, nail polish, or cellulose tape.





LIST OF PARTS

All fixed resistors ¼-watt carbon.
R1: 220,000 ohms.
R2, R7: 1 meg.
R3: 47,000 ohms.
R4: 500,000-ohm hearing-aid-type volume control.
R5: 10 meg.
R6: 3.3 meg.
R8: 4.7 meg.
C1A, B: Two-gang, cut-plate tuning condenser, midget type.
C2, C5: .0001-mfd. mica.
C3, C4, C6, C8, C9: .01-mfd., 200-volt midget paper tubular.
C7: 50-mmf. mica.
IF1, IF2: Iron-core intermediate-frequency transformers for 455 kc. Midget type.
L1: Antenna coil (see text).
L2: Unshielded air-core osc. coil, 455 kc.
S1: DPST midget slide switch.
Subminiature tubes, 2,000 to 4,000-ohm headphones.

2E32, and 2G22 in that order. Remember that you don't have a metal chassis to act as a common ground, so you'll have to interconnect all grounds just as carefully as you do the B-plus or filament lines.

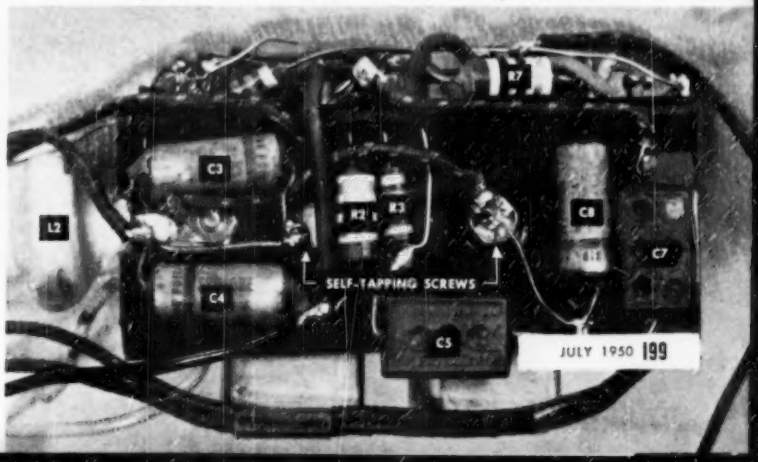
Section 3—Batteries: You will know you're reaching the home stretch when you come to the battery compartment. This contains two 22½-volt miniature B batteries connected in series and a C-size flashlight cell. Since the small cell has to be changed fairly often, it should be clipped in, rather than soldered. Good clip contacts can be made by driving two ¼" machine screws through opposite sides of the cabinet. Battery connections are indicated by the broken color lines.

Connecting the sections: The final stage of the wiring consists of running leads between the compartments. Don't forget to link the common points.

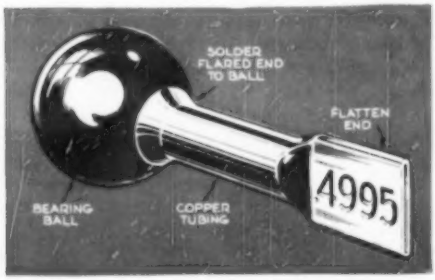
You can use any pair of high-impedance earphones to pipe the sound from the radio to your ear. The very compact, single earpiece shown on the opening page is a Telex Earset of 2,000 ohms impedance. If you get one of these, be sure to purchase it with a matching crimped-tip cord for use with phone tips; the plug-tipped cord isn't suitable.

END

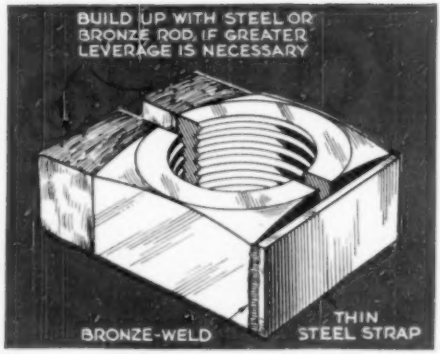
Remove the IF transformers from their cans by pushing back the retaining clips. Drill a small hole in the side of each can and a corresponding hole in the plastic strip. Attach transformers with self-tapping screws. Screw heads and solder lugs can be seen in the photo below.



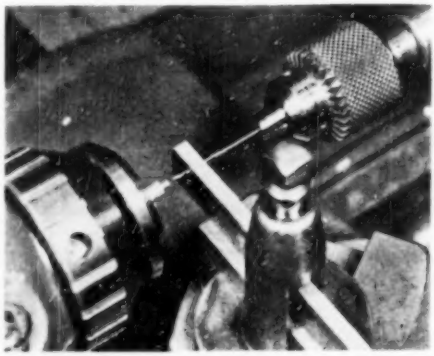
Bushing Centers Drill. If you've ever spoiled a job by getting a hole off center in a shaft, you'll appreciate this trick. Braze or silver-solder a boss alongside the top of a V-block clamp. Carefully fasten the block on the drill-press table with its V centered exactly under the spindle. Tighten the clamp on a piece of stock and drill through the boss for a bushing. You can make several bushings for various drill sizes, or use just one to spot the hole, changing afterward to a drill of the desired size.—*Floyd R. McGuckin, Ridgewood, N. J.*



Ball Forms Plug Gauge. Steel bearing balls can be had in many sizes, and since they're ground to very accurate dimensions, I've found they make good plug gauges. I flare a piece of copper tubing to fit onto the ball, and soft-solder the ball to it. Then I flatten the other end of the tubing and stamp the size of the gauge on that.—*Robert J. Hood, Ashland, Ohio.*

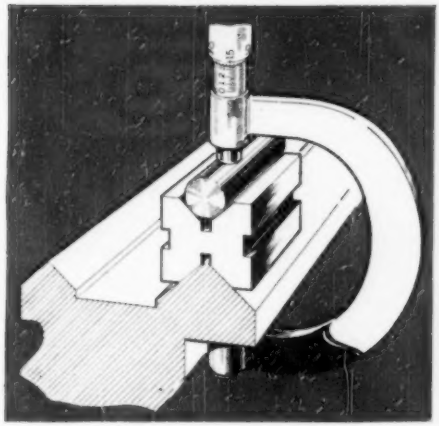


Split Nut Yanks Studs. This "persuader," shown in *Oxy-Acetylene Tips*, a Linde Air Products Co. publication, removes studs from castings without harming the threads. Saw in half a nut that fits the studs, separate the halves by the thickness of the hacksaw blade, and braze a 1/16" steel strap across two outside corners. Screw the nut on the stud and grip it with a pipe wrench. The nut halves will bind and turn the stud out. For stubborn jobs, weld on extra metal opposite the strap as shown.

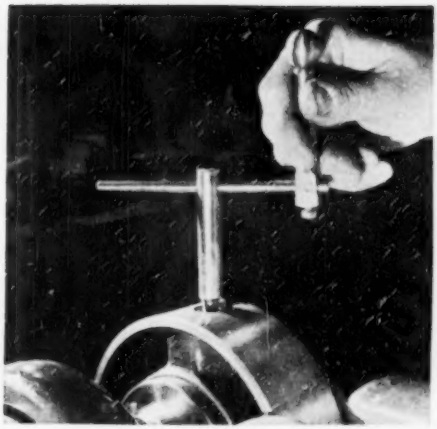


Guiding Small Drills. Holes in the Nos. 60 to 80 range are hard to drill true in the lathe because the tiny drills lack stiffness. But this method does the trick.

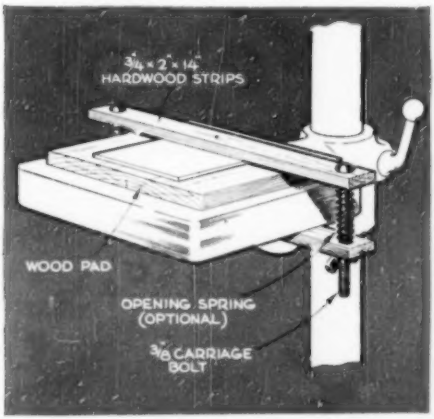
Grip the drill as short as possible in a headstock chuck. Clamp a piece of bar stock in the tool holder; then feed the carriage against the drill to make a hole in this piece. Being careful not to move the cross feed, put the drill in a tailstock chuck and the work in a headstock chuck or collet. Place the pierced bar near the work, and feed the drill through it to make the hole.—*J. C. Magee, Schenectady, N.Y.*



V Block Checks Lathe Wear. To measure the wear on the ways of a lathe, place a V block on one way and a short dowel pin or other true round piece in the upper groove. Take a micrometer reading at the extreme right-hand end, and subsequent ones 2" apart up to the headstock. The variation in readings is the wear at the different check points along the ways.—*Jesse R. Lucas, Michigan City, Ind.*

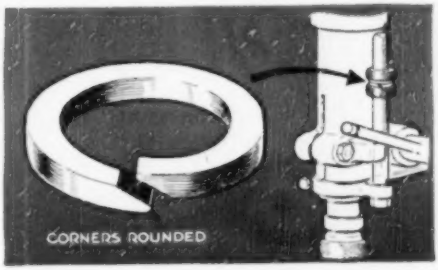


Crank Speeds Chuck Use. When reversing chuck jaws, you can save time with a key crank made from a big carriage bolt. Saw off the head, drill through the square end for the cross pin of the chuck key, and tap for a setscrew. Turn a suitable ball, or chuck an annealed bearing ball and drill a 3/16" hole through. Shoulder down the threaded end of the bolt to a drive fit in the ball.—*Joseph Tracy, Manhattan, N.Y.*



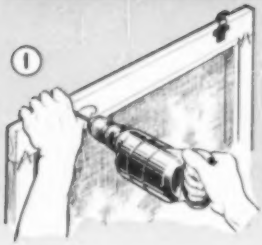
Clamp for Drilling. With this device on the drill press, you won't be tempted to hold work by hand because you're in a hurry or C clamps won't fit. It consists of two hardwood strips joined by carriage bolts. With it, flat stock of any kind can be accurately located and quickly secured. It's also handy as a stop against which to hold a drill-press vise, or a fence for routing or planing.—*H. L. Campbell, Oak Park, Ill.*

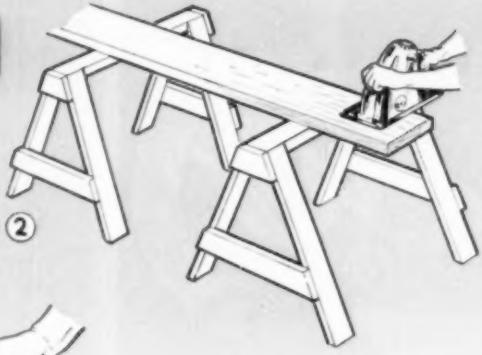
Flatiron Tempers Tools. After hardening small pins, punches, and other parts with a gas flame in our shop, we lay an old electric iron upside down and set its thermostat at 550°. We then put the hardened pieces on the sole of the iron, turning them slowly until the desired quenching color appears.—*G. R. Wyatt, Dover, N.H.*

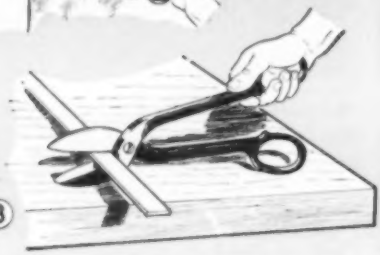


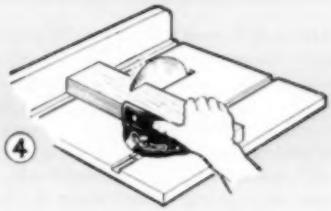
Washer Locks Depth Nuts. The depth stop nuts on my drill press often loosened after I had drilled a few holes. To end this nuisance, I ground off the sharp corners of a lock washer and put it between the two thumb nuts, which now stay locked. —*F. E. Riley, London, England.*

WHAT'S WRONG ?



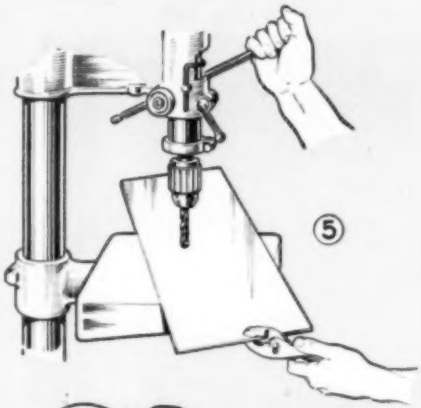


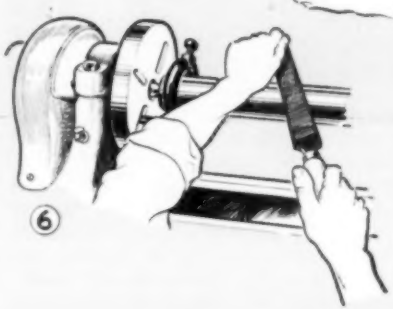




Good tools are a short cut to good work, but some handymen discover short cuts the tool manufacturers never intended. What's wrong here from a safety standpoint?

1. Drilling blind holes in a screen frame this way saves clearing off the workbench. 2. A portable electric saw quickly trims planks. 3. Husky tin snips will cut fairly heavy metal if braced against the bench top. 4. The rip fence is handy as a gauge stop for cutting short pieces to identical size. 5. Pliers keep sheet metal from turning under the drill. 6. A shaft is smoothed by lathe filing.





Answers

1. The drill may skin the thumb, and may run through into the fingers behind.

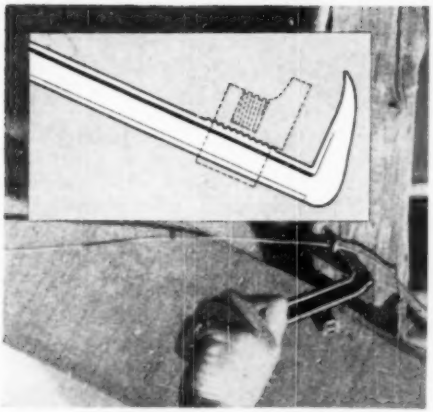
2. Since the plank is free to slide, the least that can happen is a crooked cut, the worst a dangerous slip of the saw. Clamp the plank.

3. As the blades snap through the stock, knuckles will be pinched between the handles. Keep fingers inside the handle eye.

4. Pieces may jam between blade and fence. Use a stop that doesn't go as far back as the blade.

5. The big drill will grab sheet metal and yank it free. Riding up on the drill, it may whirl around dangerously. Clamp it down.

6. The whirling lathe dog may smack your left wrist or elbow. File left-handed on the lathe.

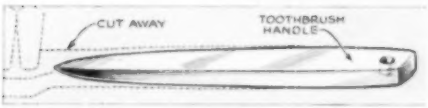


Wrench Is Staple Puller

A STRONG, simple, and long-lasting staple puller can be made by removing the movable jaw from the type of monkey wrench shown and drawing the tip of the fixed jaw out to a point. The point is driven through the staple and the handle used as a lever to extract it. The tool will stand rugged use. —*E. V. Reyner, Townsend, Montana.*

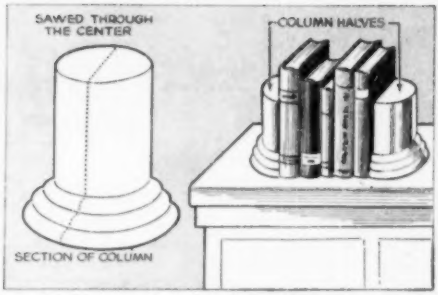
Tweezers for Splinters

BETTER than the usual needle for nabbing splinters is a pair of stamp tweezers with the ends ground and honed to fine points. Keep the tweezers with a bottle of antiseptic by a rubber band.—*Robert Hertzberg, Jackson Heights, N. Y.*



Plastic Needle Sews Burlap

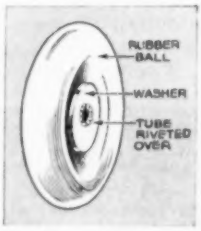
THE handle of an old toothbrush, when cut to a point, makes an excellent needle for sewing burlap and other such coarse-weave material. You can put a point on the handle with a coarse grindstone, coarse paper on a belt or disk sander, or a medium file. To make the eye, heat up the point of an ice pick or nail and bore through.—*Mrs. W. P. Blissitt, Cedartown, Ga.*



Book Ends Made of Old Column

A BASE section from a dismantled colonnade or porch column makes an attractive set of book ends when sawed in two. A thorough sanding and application of a stain and varnish produce a piece of work that will appear to be a lathe project, yet you will have done the job quickly and with little effort. Depending on the column you get, you may wish to fit filler blocks in the top, add sheet-metal bases, and weight the halves with lead.—*Victor H. Lamoy, Upper Jay, N. Y.*

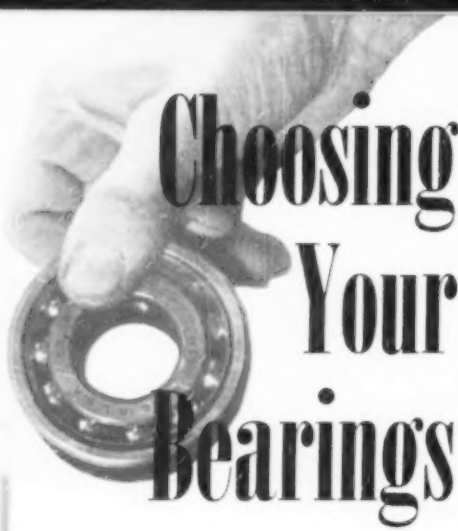
Balloon Tires for Toys



BALLOON-TIRED wheels for toys and models are easily made from hollow rubber balls. Bore a hole through the ball, place two large washers on opposite sides of the hole, and insert a short metal tube in the opening. Press the washers together to get the desired wheel shape and thickness and expand the ends of the tube with a punch and hammer. Rivet over the tube ends to grip the washers securely.—*Frank Shore, Manhattan, N. Y.*

Save Acid in Solder Core

BEFORE putting away a roll of acid-core solder, pinch the end of it with a pair of pliers. This seals it off and prevents the flux from leaking out. It makes a roll last longer and do better work.—*Virginia Hanson, Santa Monica, Calif.*



Choosing Your Bearings

By Walter E. Burton

WHEREVER things turn, you need bearings. Whether you're building a weather vane, a drag saw, or an HO-gauge locomotive, you must provide something for shafts to turn in. It may be nothing but a hole in a piece of wood, or you may need a tiny, precision ball bearing ⅛" across the outside. Both kinds, and many others in between, have their place.

Wooden bearings. These aren't outdated by any means, and will carry surprising loads. Big thrust bearings that take the push of ships' propellers are still made of lignum vitae, the hardest wood known.

You can make good wooden bearings from maple or other hard, close-grained wood. Bore the hole a close running fit for the shaft, across the grain. If you want to take up for wear, saw from one edge to the hole and drill across this kerf for one or more take-up bolts, as in Fig. 1. Use washers under the boltheads and nuts. Soak the bearing in oil or hot grease.

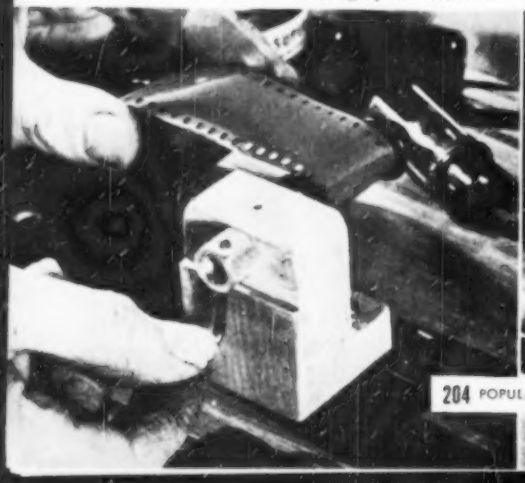
Lined bearings. A durable bearing can be made in a softwood block by lining an oversize hole with a bushing, which may be a piece of pipe or tubing, or a wire coil. To form a wire bushing, wind brass, copper, or bronze wire on a rod or mandrel the same diameter as the shaft, or even on the shaft itself. Holding the turns tightly together, solder them on the outside. Remove the coil and push it into a hole bored in the wood. Wire bushings should be made extra long, as the load lies tangent to the wire and the bearing area is small. Large sleeves can be wound undersize and reamed to shaft size for more bearing area.

A similar liner can be made by winding wire solder on the shaft, and simply fusing the turns together with a hot iron.

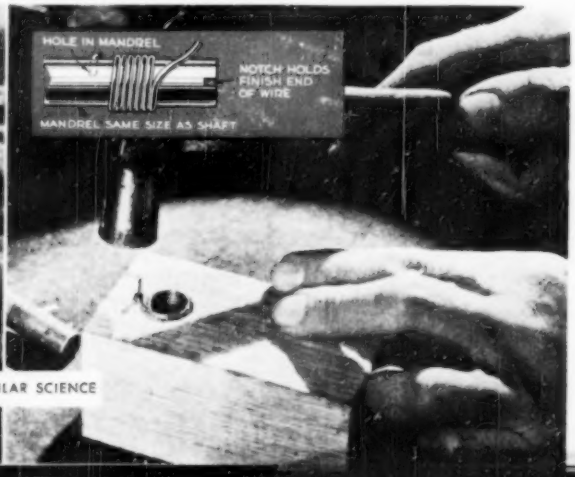
Babbitt, a lead-tin alloy, has long been used to line bearings, and is easily poured in the home shop. To make a babbitted bearing in a wooden block, bore the hole considerably larger than the shaft, and cut or file anchor slots for the metal (Fig. 2).

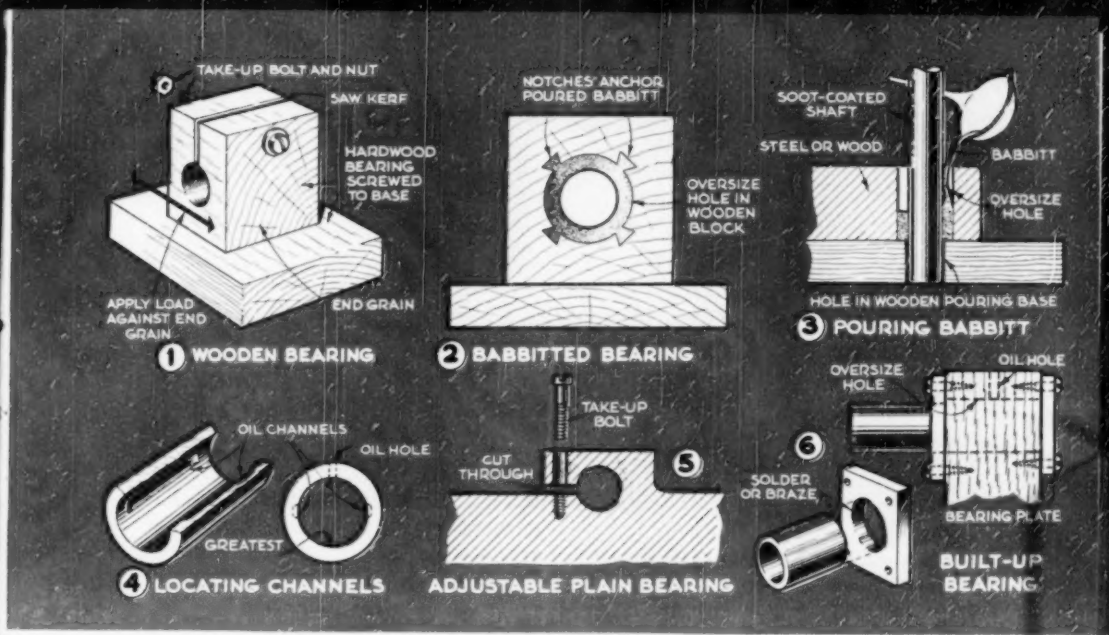
Babbitt can be poured right around the shaft, so forming a bearing of the right size, but you have to hold the shaft properly lined up in the hole, and keep the poured metal from flowing out at the ends. The easiest way to do this is to pour the bearing in a vertical position as shown in Fig. 3. Heat the shaft a bit hotter than boiling water to prevent rapid chilling of the molten metal. Some mechanics coat the shaft with chalk or graphite for easier removal, or

A small maple block forms both standard and bearing for this little film winder. Wooden bearings will do for much heavier duty than this if well made and thoroughly lubricated.



Wire liners for wooden bearings can be made by winding wire on a mandrel or the shaft itself. Turns are soldered together. If liner isn't tight in the hole, tack wire ends fast.





apply oil and smoke the oiled surface.

After pouring the bearing, carefully work out the shaft and clean it. Drill oil holes and, in long bearings, gouge oil channels where the load is lightest (Fig. 4).

You can cast babbitt in a metal shell or housing the same way, but instead of cutting anchor notches, simply tin the inside of the bore with solder so that the babbitt will bond with it. In aluminum or other metal to which solder won't cling, cut coarse threads or slots to anchor the lining.

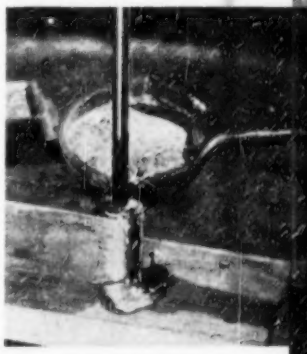
Solid bushings. Bronze bearing sleeves, or bushings, can be bought in a variety of kinds and sizes. You can also buy bronze bearing stock for machining your own. Self-lubricating bearings, which need no oil, are usually porous in structure and saturated with lubricant. Split or slotted sleeves are used for adjustable bearings.

Some sleeves have flanges, grooves, or pins to hold them in place, but most of them are pressed in. If a sleeve is a trifle undersize for a press fit, it can sometimes be made to serve by tinning the outside with solder. Pressing in a thin-walled sleeve may reduce its outside diameter so that the shaft won't fit. The answer, of course, is to ream it to size *after* it's installed. If a bearing consists of two sleeves some distance apart, they should be line-reamed, that is, a long reamer should be run through both at once.

Sometimes a tight sleeve can be inserted by heating the housing to expand its diameter. Or you can shrink the sleeve itself by chilling it in a refrigerator or with dry ice.

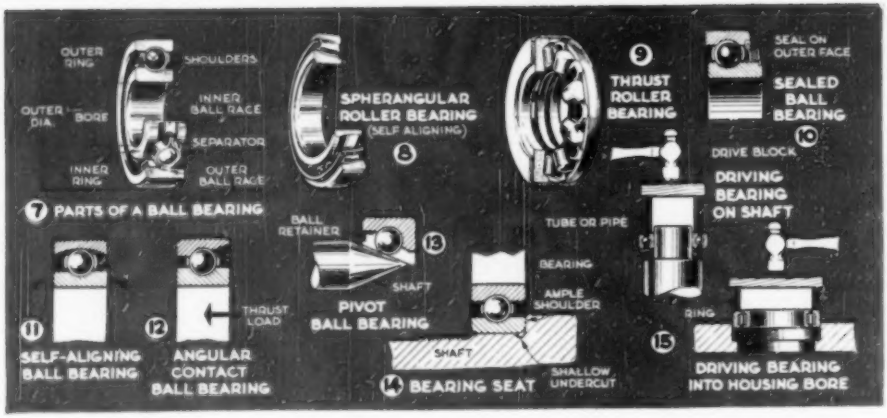
In machining your own bushings, try to turn the outside and drill or bore the inside at the same chucking, or else bore the inside and mount the bushing on a true-running mandrel to assure concentricity.

Plain bearings. A clean, true hole in



Babbitt bearing is poured in a metal housing around the soot-coated shaft. Charcoal sprinkled over molten metal helps minimize formation of dross. Shaft is preheated to 250°.

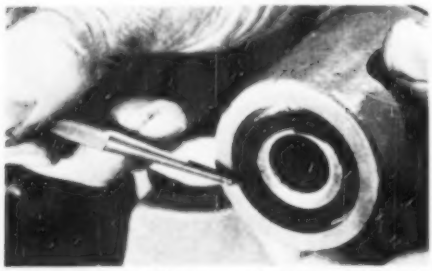
Self-capping oil cups like these are simply pressed into suitable holes. Grooves inside the bearing help distribute lubricant. For long wear, cut grooves where load is lightest.



steel, cast iron, brass, and some alloys will make a serviceable bearing. Some excellent lathes have cast-iron spindle bearings. Properly lubricated, they stay accurate for years. The porous structure of cast iron holds oil and makes it a good bearing material.

To get a good fit for a shaft, drill the hole slightly undersize. Then bring it to size with a reamer, or with a second drill. To provide for adjustment, saw a slot through to the hole and provide a take-up (Fig. 5).

Hand lapping frees a close bearing fit to running clearance. If the bearing isn't adjustable, use only fine compound. Clean both the shaft and the bearing of all traces of abrasive.



A felt ring seals the bronze bearing in this tool-post grinder against the grinding dust.

Substantial metal plates fastened to a wooden block by wood screws or by bolts will serve for light-duty bearings. The oversized shaft clearance hole through the block forms an oil reservoir. For a longer bearing, a bushing or a piece of tubing can be soldered, brazed, or welded inside a hole in a mounting plate. Such a bearing can project outside the mounting block, as in the drawing, or can extend partly or wholly inside.

Don't overlook the tapered bearing, long used in some lathes and milling machines. The bearing and that part of the shaft within it are both tapered, the slope being steep enough to have no wedging or binding effect. Play is taken up by tightening a thrust collar to move the shaft endwise, into the bearing. In making such a bearing, bore it and turn the corresponding shaft taper at the same setting of the compound rest.

Lapping. Plain bearings, tapered or straight, will fit better and wear longer if they're lapped to the shaft. Use a lapping compound to suit the metal—"soft" for bronze or babbitt bearings, "hard" for cast iron. Spread coarse abrasive sparingly on the shaft and inside the bearing, adding a little oil or kerosene. Turn the shaft by hand and move it endwise at the same time. Tighten an adjustable bearing a little as lapping continues. When the surfaces are lapped smooth, clean off the coarse compound and follow with fine one. Add more oil, but not compound, until you finish lapping with oil alone. Then clean all parts *thoroughly* and re-oil. If a bearing isn't adjustable, be careful not to lap it to a loose fit.

Antifriction bearings. The caveman who rolled a big log along across smaller ones invented the first antifriction bearing. Today's include ball, roller, and needle bearings, of which a few are shown in Figs. 7 to 13. You can't make your own, but with a little care you can select and install antifriction bearings in new gadgets, or replace worn ones in old.

What kind of bearing to use depends largely on the kind of load it must carry—whether radial (at right angles to the shaft), thrust (endwise or parallel to the shaft), or a combination of the two. Broadly speaking, radial ball bearings are for radial loads only, with little or no thrust load. Ball or roller thrust bearings are for end thrust only, while angular contact ball bearings, tapered roller bearings, and spherical-angular bearings will carry both radial and thrust loads.

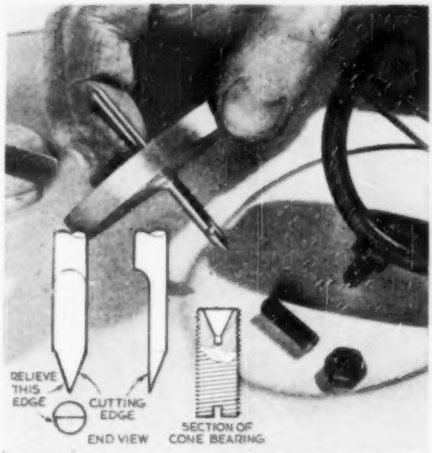
Self-aligning bearings have races that allow the shaft to run at a slight angle to the outer race. Shielded bearings are fitted with circular plates attached to one or both outer rings to keep out chips and dirt, but require lubrication, while sealed bearings have plates with gasketlike linings that retain lubricant for long periods.

It's common practice to make antifriction bearings a press fit on the shaft and a push fit in the housing bore, or to make the rotating race a press fit and the nonrotating race a push fit. If both were tight fits, thermal expansion might damage the bearing, while a light fit on a rotating shaft might let the inner ring turn and wear.

In machining bearing seats, a ground finish is preferable. When seats are merely turned or rough ground, the bearing rests on microscopic ridges, which in service are peened down, leaving the bearing loose. Enough of a shoulder should be left to align the bearing squarely on its seat. A low shoulder may let the bearing corner ride up. So may too large a fillet. It's good practice to turn a shallow, rounded undercut for clearance at the corner of the outer ring (Fig. 14).

Preloading, as the name implies, means that the bearing is installed under pressure in the same direction as the applied load, usually by a thrust washer and nut. This removes end play and keeps the bearing from shifting under load.

Installing antifriction bearings. Cleanliness is law in handling ball or roller bearings. Shaft seat and housing bore must be scrupulously clean; the least dirt may throw the bearing out of alignment.

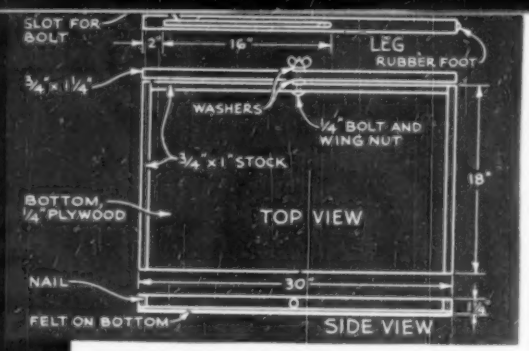


Pivot bearings in this gyroscope are adjustable in threaded holes and clamped with lock nuts. Sockets are first drilled, then reamed with homemade reamer not quite to the bottom.

Oil won't readily coat solvent-moist metal, so clean, dry air is useful for blowing out solvent after cleaning. Here hose is rigged over a can. Bearing is held so it can't spin.

Bearings may be heated cautiously to about 250°, preferably over a lamp bulb, to make press fits easier. Be very careful to apply pressure evenly all around so as not to cock the bearing. If a hammer must be used, tap on a ring or a tube that fits the bearing race as shown in the drawing. Never hammer any part of the bearing directly. To press a bearing on a shaft, apply force to the inner ring; to press it into a bore, apply force to the outer ring—in both cases pressing the ring that is in direct contact with the seat, as in Fig. 15.

To clean antifriction bearings, soak them in kerosene or gasoline, brushing off external dirt. Never spin a dirty bearing in the fingers. Rinse washed bearings thoroughly in clean solvent. If you blow them dry with compressed air, be sure it's free from moisture and dirt, and don't let the airstream spin the bearings. Oil a cleaned bearing at once and wrap it in clean paper if it's not to be installed right away. END



Here's a Table for Your Chair

You can relax while you work at this desk. It can be built in an evening, used with a side chair or armchair, and folded flat when not needed. The layer of felt glued to one side makes it ideal for card games. Then, if you want to write, you can turn the top over. The 1" rails on three sides keep paper and pen from slipping off the top.

The adjustable support is a strip of hardwood that's slotted for 16" as shown. Attach the leg to the tray with a ¼" stove or carriage bolt and wing nut. Run the bolt through the hole in the edge strip and the slot in the leg.—*Roland Cueva, Newport Beach, Calif.*

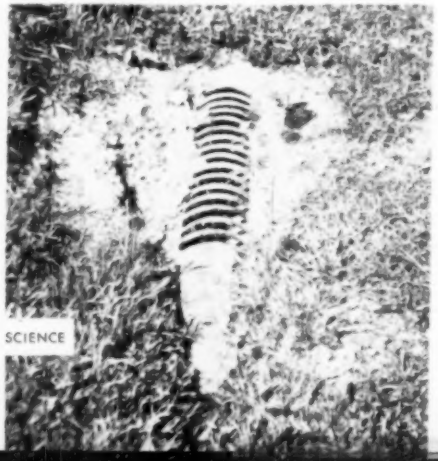
Chemical Removes Boat Paint

No more chipping and scraping paint from hulls if you use this new chemical that disolves the paint. It's a powder called Nelrem that's mixed with hot water (about 165° F.) and then sprayed on the boat under 6 lb. pressure. The Nelrem Corp., New York City, says it dissolves any oil-base paint at the rate of 150 to 350 sq. ft. per hour—depending on the type of coating and the number of coats. Nonacid, noninflammable, it can be used on autos, furniture, or buildings, but not on linoleum or leather.

Grille Cut in Drain Pipe

To carry away rain water, this simple catch basin with strainer was made by cutting a series of slots in the top of the 8" pipe that's used as the drain.

The strips of metal left between the slots allow the lawn mower to roll over the drain. At the same time, the metal strips stop the entry of sticks and trash that might clog the drain and cause trouble. By cutting such slots, a buried pipe may be equipped with catch basins at each low point in the yard.—*Elton Sterrett, Houston, Tex.*



A small, outboard-powered skiff skims dry through white water when fitted with splash rails.

Aluminum Strips Make Splash Rails

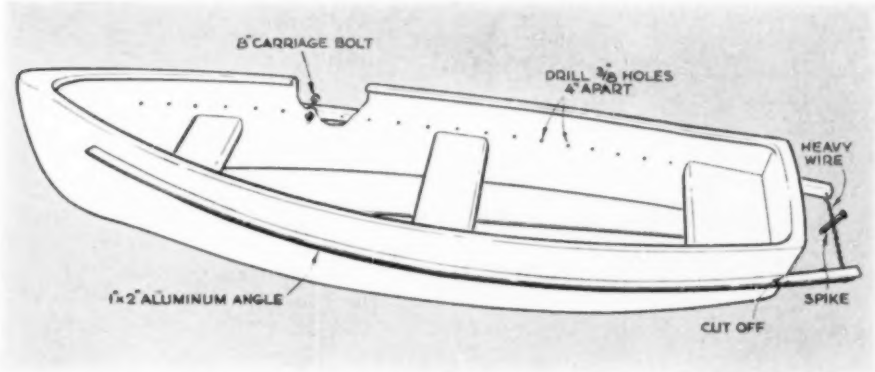
THE photo at the top of this page gives you an idea of the rough and tough water I can run in complete safety since I bolted aluminum splash rails to my 12′ skiff. Before, it was impossible—I shipped too much water.

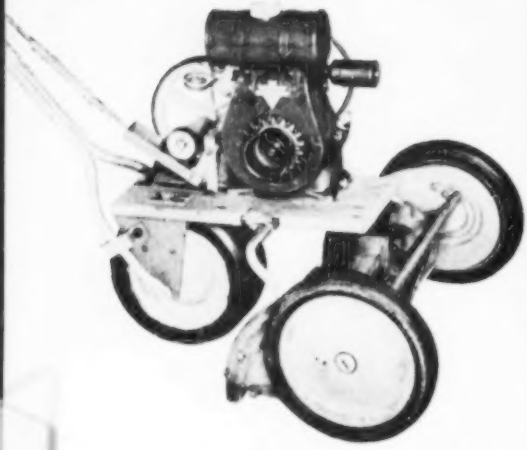
I used 1″ aluminum bolts to tie the rails to my boat. If your boat is a wooden one, you may have to use longer fasteners. If you buy strips of aluminum angle that will project past the stern, you can use wire to pull them together at the stern. If you buy them just the right length, you can pull them in with a carriage bolt.

Here's how I located the rails. I measured the distance from gunwale to keel at several points. Then I drew a line on the hull a third of the way down from the gunwales.

Drill ⅜″ matching holes at 4″ intervals in the 1″ side of the angles and in the hull. Start bolting at the widest part of the boat and work toward the bow. Use a ⅜″ by 8″ carriage bolt several holes ahead of where you're working. Tighten the carriage bolt inside the hull to draw the rail down and fasten it with the aluminum bolts. Then move the big bolt ahead.

At the stern, loop a heavy wire between holes in the very end of the rails. Twist the wire with a spike to pull the rails to the boat's side. Then bolt the rails in place and hacksaw off the projecting parts.—*A. M. Chase, Wenatchee, Wash.*





Gasoline Power Unit Clamps to Your Lawn Mower

You can add power to your old push-type lawn mower with this MidgeTractor. You remove the old handle, snap the unit in place, tighten a couple of bolts, and you're ready to chug over the lawn.

An air-cooled gas engine drives it. One V belt carries the drive from the engine to a countershaft, another from the countershaft to a pulley between the double wheels at the rear. A clutch control runs up the handle. You turn the mower by lifting the rear wheels from the ground.

Complete with a 1½-hp. engine, the unit sells for about $55. However, you can use your own gas engine or electric motor. In that case, the rest of the unit costs $30. The maker is LeJay Manufacturing Co., Minneapolis, Minn.

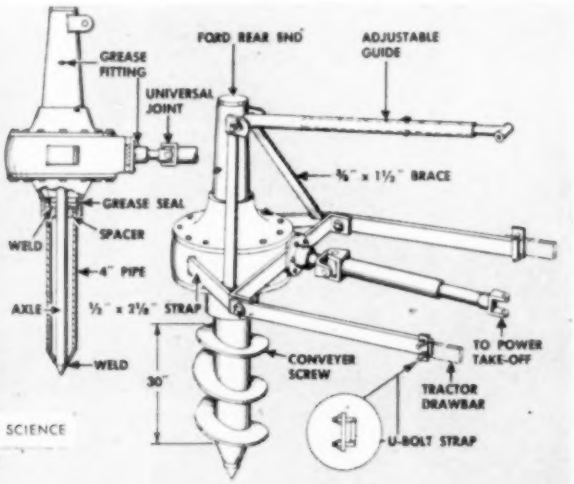
Rear Axle Provides Gears for Posthole Digger

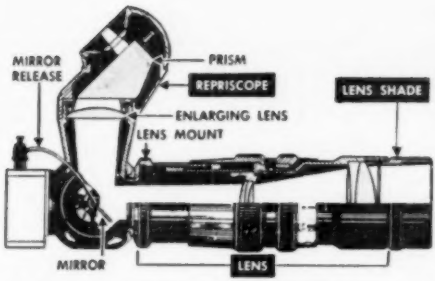
Starting with an automobile rear axle, a farm welder can make a posthole digger like the one below. A tractor power take-off, fitted with a universal joint, drives the auger.

Cut away the axle housing on one side, letting the axle extend 30" or more. For the auger, weld a conveyer or stoker screw to some 4" pipe. Slot the end of the pipe, hammer it to conical shape, and weld to the pointed axle shaft. Use a spacer to support the pipe on the axle, and a grease seal to keep the lubricant in. The differential gears must be locked or the upper shaft fixed from turning.

Cap the axle housing on the upper end. Fillet-weld the straps and braces in place. The adjustable upper arm consists of ¾" pipe telescoped in 1½" pipe.

Drawings for the project were prepared by the Lincoln Electric Co., Cleveland.





Gunstock Camera Shoots Closeup Photos Far Away

Using this outfit, you really "shoot" photos. A gunstock against your shoulder keeps the camera steady as you aim the telephoto lens at a distant subject. Pulling a trigger takes the shot.

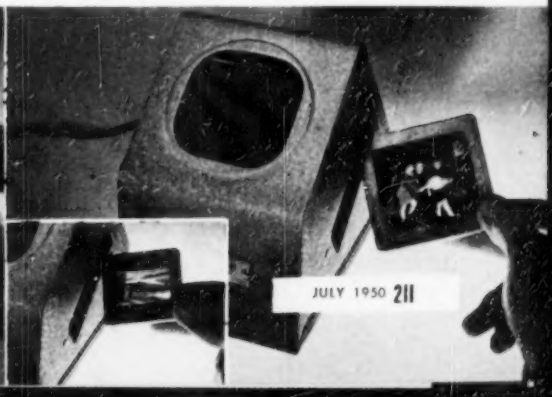
You see the scene through a viewer called the Kilfitt Repriscope. It's mounted between the telephoto lens and camera body. The optical system magnifies the scene and places the subject upright, with right and left sides in correct position.

As you pull the trigger, the cable release first operates a secondary cable, running into the side of the viewer. This swings a front-surface viewing mirror up out of the way. The cable then trips the shutter. To prepare for another shot, you return the mirror to viewing position by depressing an arrow-marked knob.

The Repriscope can be used with four 35-mm. cameras—Leica, Contax, Foton, and Ektra. It's distributed by the Peerless Camera Stores, New York.

Viewer Shows Color Slides of Different Sizes

Shown at right below is a viewer that gives you an inexpensive way of looking at color transparencies taken by the popular 2¼" by 2¼" cameras. Flip a hinged adapter and you can also use it to view 35-mm. or Bantam-size slides (inset). An optically ground lens enlarges the image 1½ times and gives a third-dimensional effect. Listed to sell at about $6, the viewer is a product of Brumberger Co., Inc., of Brooklyn, N.Y. This company also makes the other slide accessories shown at left. The previewer gives a quick look at 35-mm. slides before you project them.



Here's How You Can

Build a Case for Your Camera

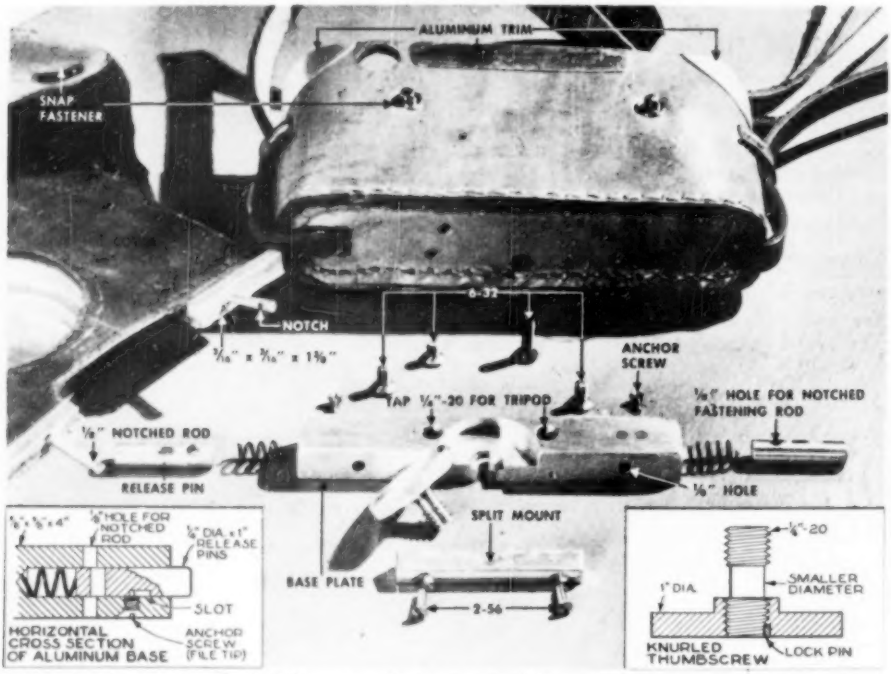
Leather scraps bought at a leather-goods shop were used to make this case. A special lock permits quick removal of cover when desired.

AN OLD brief case or handbag will often yield enough leather for a case tailored to fit your camera. Even parts of shoes and gloves may come in handy. Ordinary shoe dyes will even up color variations.

The case shown here is the popular ever-ready type. When the fasteners are unsnapped, the cover flap drops out of the way so you can take a picture without removing the camera from its case. An aluminum fitting under the case lets you detach the cover quickly whenever you want to. Snap fasteners could be used here if you don't have metal-working facilities.

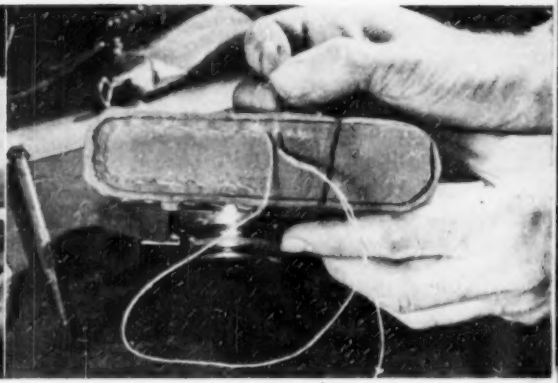
Cut and fit cardboard around the camera in the shape of the various case elements. Four or five separate pieces are required. You will want a velvet or other soft lining inside, so allow for this in the cardboard patterns.

You can cement the lining to the leather pieces before assembly, but you'll probably



Spring tension against the 1/4"-diameter pins keeps the 1/8" notched cover rods locked in place.

Cardboard patterns fitted to the camera help cut leather. Cut the patterns big enough to allow for bending and the lining.

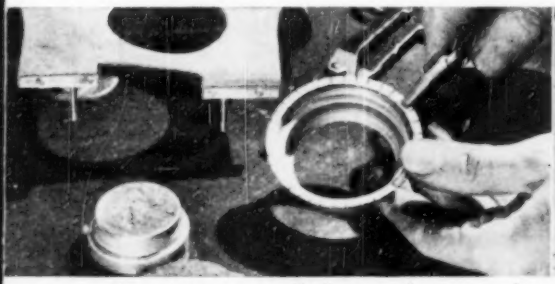


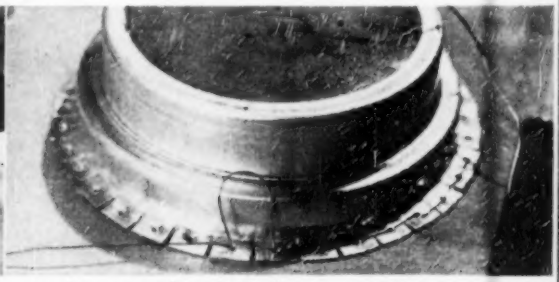
Sew on the bottom after fitting the main part around camera. Punch holes first with an awl. Use a strong thread—silk, nylon, or linen.

find it better to wait until all the seams are complete. The leather pieces can be joined by cementing, sewing, or both.

Sear the leather edges lightly with a soldering iron and then rub with a cloth. This produces a smooth finish and rounds off the edges. Some exposed edges in the body of the case shown were protected with aluminum cemented with Pliobond. Install snap fasteners to keep the flap closed.

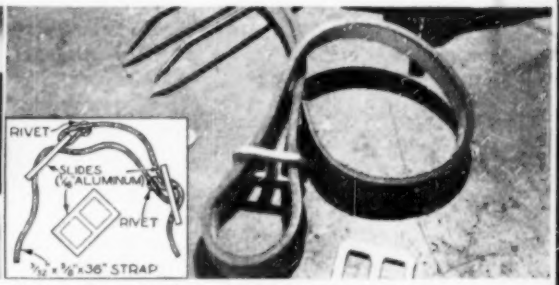
A front-flap recess to cover the lens can often be fashioned from a ready-formed cap or cup as suggested in the accompanying photos. Cement protective velvet over the



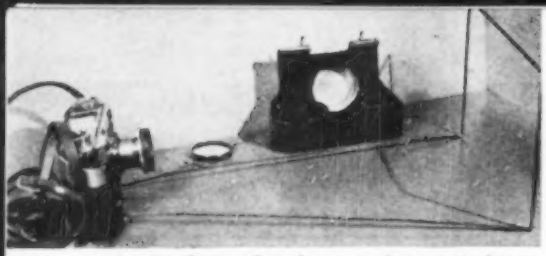


Lens recess was made from an aluminum gelatin mold. The bottom of stepped mold (lower left above) was cut off. Edge of other piece was then snipped, and tabs bent out as above. Fine wire was run through drilled holes to keep it in place. Cemented leather disk closes the end.

Cover is removed or attached by pressing in the push-button plugs and pulling out or inserting notched rods. Base has two tripod sockets.



Metal slides fitted as shown make strap adjustable. Strap ends are riveted to bottom of case and pass under loops sewed to the sides.



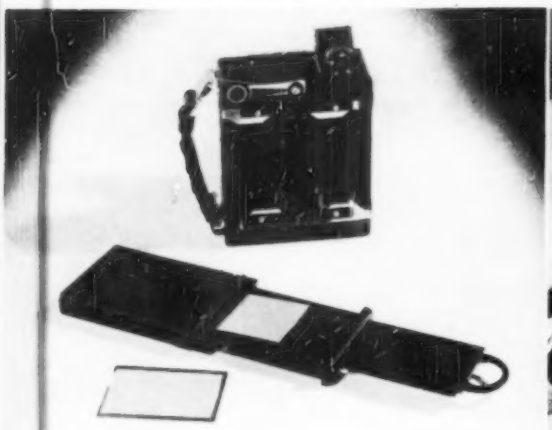
A wire frame for close-up photos attaches to metal base after cover is removed. Used with supplementary lens, frame outlines picture area and marks the point of sharpest focus.

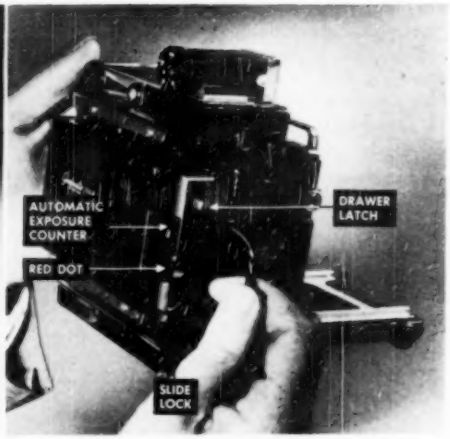
wire stitches on the inside surface, and check to be sure nothing can scratch the camera.

The aluminum fitting on the base of the case holds the camera in, provides quick release of the cover, and also holds a wire focusing frame. An "exploded" photo on a previous page shows its parts. Note that the cover is held to the aluminum base by two notched rods that fit into holes in the side of the block. With the cover attached, the notches are engaged by two release pins held out by spring pressure; when you want to take the cover off, light pressure on the two release pins frees the rods. Tiny, filed-down screws engage grooves in the release pins, keeping them from falling out and preventing them from turning.

The advantage of the split mounting for the knurled thumbscrew is, of course, that it enables the thread to be larger than the hole around the neck of the screw. This keeps the screw from dropping out when you loosen it to remove the camera.—*Walter E. Burton, Akron, Ohio.*

Cut-Film Holder Takes Six Shots at One Loading





A NEW cut-film magazine announced by Graflex, Inc., enables you to take six shots in quick succession. At present it's available only for 2¼" by 3¼" cameras.

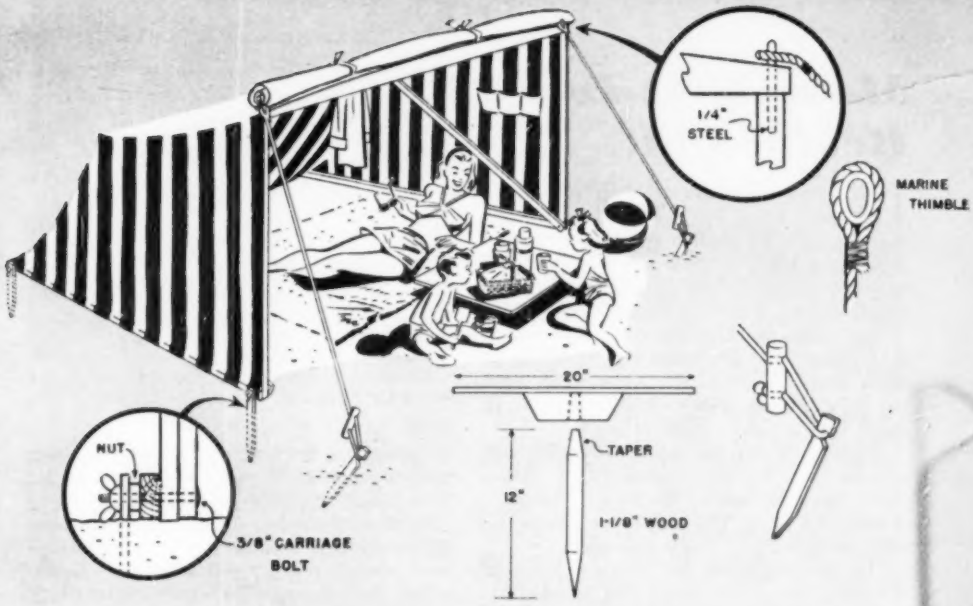
No larger than a film-pack adapter, the Grafmatic Film Holder fits on the camera back like a conventional holder. To prepare for an exposure, you turn the slide lock, pull out the slide, and immediately reinsert it. While the slide is out, a spring pushes a sheet of film ahead of it—ready for exposure. A red dot appears on the magazine back, showing the film is ready.

After making the exposure, you hold down the drawer latch and pull out the handle. This pulls out the entire drawer, containing the unexposed films, and allows a spring to force the exposed sheet into the back of the case. For another exposure, pull out and insert the dark slide as before.

The film holder sells for about $16.

Gooseneck Positions Reflector

WITH this gooseneck attachment, I can swing my flash reflector to any desired position. A hole was drilled in the camera box and the gooseneck attached with a bolt and wing nut. The reflector clamps on the lamp socket.—*W. C. Vestal, Redlands, Calif.*



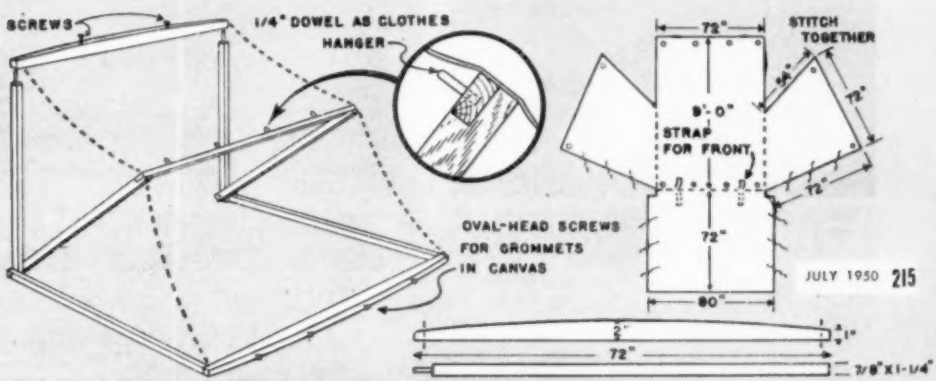
You Can Take Shade with You

HERE'S an inexpensive, easily built shelter for beach or camping. It protects you from sun and wind, does duty as a dressing room, and folds up neatly for carrying. No special racks are necessary to haul it in your car.

Pegs for hanging up clothing and pockets for small articles are provided. A one-legged table with a top of ½" waterproof plywood keeps food and beverages up out of the sand. The leg of the table is pointed so it can be shoved down in the sand to hold the table steady. Each corner and the two guy ropes are firmly anchored with steel stakes. Assembly of the frame is shown. The three struts on each side are bolted at the lower front corner. Crown beams fit over steel pins.

Striped awning cloth makes an attractive covering. One of the drawings shows how to cut it. Grommets are put in where indicated and cloth straps provided for holding up the rolled front wall.

When you're ready to start for home, tie the struts and beams to the bumper of your car. Stow canvas, stakes, and table in the trunk compartment.—*Hi Sibley, Nuevo, Calif.*



Make That Toy Really Sail

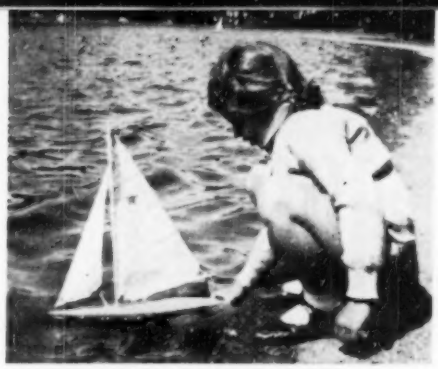
LOW-COST toy sailboats look seaworthy enough when you see them on a store counter. But it's another story when they're sailed in a lake. To their small owners' dismay, they usually are tipped over by the wind, or else they sail aimlessly in circles.

But with a few changes to compensate for bad design, the toy boats can be made to skim smoothly across the water. You need an 8-oz. fishing sinker, a short length of brass tubing, and a piece of cord.

Pull the rudderpost out of the rudder and reverse it so the tiller points astern. Ream the rudderpost hole in the deck so the brass tubing will fit it. The rudderpost should be able to turn freely inside the tube.

Tie the mainsail to the mast and boom at 2" intervals. This keeps the wind from spilling out of the sail. Fasten the sinker to the keel as shown. Then place a block of wood against the front of the keel and drive it back to within ¼" of the rudder. Now the boat rides with bow slightly raised.

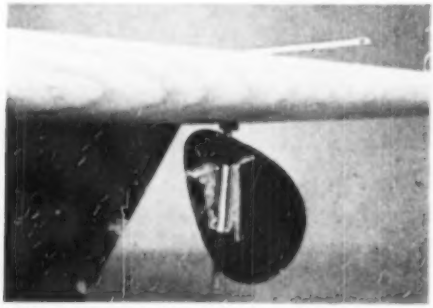
With this rudder arrangement, the boat sails a straight course. Wind fills the mainsail, causing the boat to head up into the wind. But the boom pulls the tiller over and the boat falls off again and keeps on course. —*A. C. Kubitz, Millbrae, Calif.*



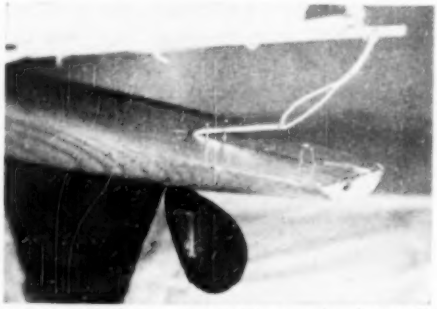
Seaworthy sailboat is launched. With new rudder and tiller arrangement, toy ship will sail a straight course and is hard to capsize.

Sinker is slotted three-quarters of its thickness. Three 5/32" holes are drilled in keel as shown, and sinker then is slipped over keel.

Sinker is tapped lightly and evenly on both sides of keel. This forces lead of sinker into 5/32" holes, and secures sinker to keel.



Tiller is reversed and rudder soldered to rudderpost in new position. Brass tubing through deck lets rudderpost turn freely.



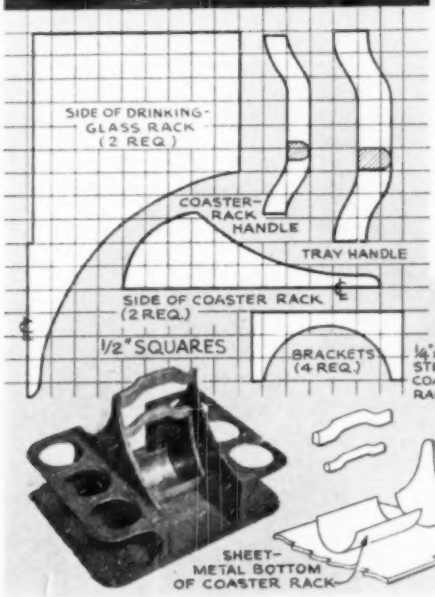
Swing of tiller is stopped by two brads 3/16" on each side of tiller and ⅜" back of rudderpost. Cord is tied between tiller and boom.

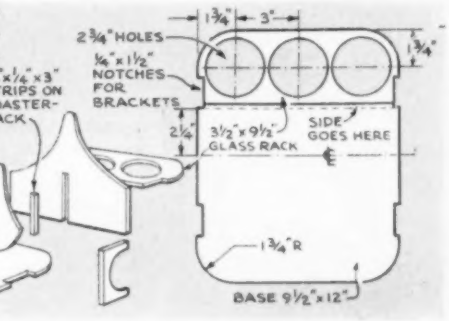
Rack Carries Glasses, Coasters, and Napkins

THIS combination drink server is a boon to any informal party. Holding half a dozen tall glasses, the tray also has a handy center compartment for coasters and napkins. Making it is only an evening's work.

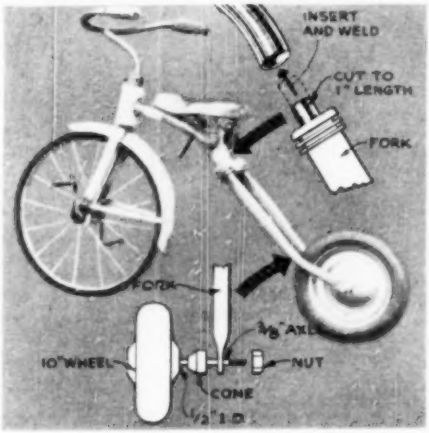
Use ¼" plywood to make the bottom, sides, and glass retainers, and ½" hardwood for the handles. For the bottom of the coaster tray cut a 5¼" by 3 15/16" sheet of thin brass, copper, or aluminum and bend it into a half circle.

Assemble the coaster holder separately, and tack a thin wood strip to each side. Saw corresponding slots in the large sides so the coaster tray will be free to slide up and down. Its weight will hold the napkins in place. Sand each piece individually and assemble the rack with glue and brads. Finish it with a waterproof varnish or enamel.—*J. Brumfield, Philadelphia.*





Cut-Down Tricycle Becomes a Two-Wheeler



MY YOUNGSTER had reached that in-between stage where he'd outgrown his old tricycle but wasn't quite ready for a bike. I put him back on wheels with the low-slung, easy-to-ride bicycle shown at the left. It is made from the old tricycle, the front fork and axle of a standard bike, a 10" rubber-tired ball-bearing wheel, and a couple of cones, washers, and nuts.

The sketch shows how I mounted the wheel in the fork, using the cones to center the standard ⅜" bicycle axle within the ½" inside sleeve of the new wheel. I left about 1" of tube at the end of the fork, sawed off the tricycle frame, and inserted the tube into the frame. After lining up the wheels, I welded the frame and fork together.—*Edward H. Roberts, Moline, Ill.*

Now You Can Patch Metal With a Brush or Knife

COLD metals that are applied with a brush or knife can be used for almost any metal-mending work around the house. You also can use them on wood, plastic, or other surfaces without heat or special tools. You can build them up in layers to make patches of any thickness. While soft they can be molded; after they are hard, they can be machined, ground, or drilled.

These plastic metals—aluminum powder mixed in vinyl-resin binders—will withstand extreme cold and above-boiling heat; they're waterproof, rustproof, and can resist pressures of 150 pounds a square inch.

Modern plastic metals have been used for several years by industry. They are now coming out in kits designed for the home handyman. One such kit, called Met-L-it, made by the R. M. Hollingshead Corp., Camden, N. J., is pictured in photo 1. Steps in a typical repair job are shown in the photo-sequence below. Some of the other applications that are possible are illustrated on the opposite page.

Here's How to Do It

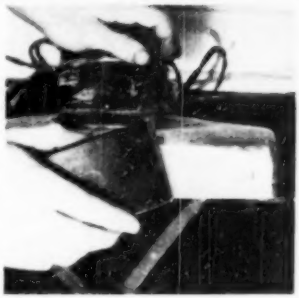
1. The household kit, left, contains a roll of fiber used for bridging large holes, cans of metal paste and solvent, a brush for applying paste, and sandpaper.

2. Repairing a broken vacuum-cleaner housing is now a simple job. First file the area around the break to clean and roughen the metal. This improves adhesion.

3. Cut a fiber patch, dip it in solvent to soften it, and press it over the hole. Shape the patch with your fingers. It dries fast, sticks firmly to metal.

4. When fiber is dry, feather the edges with coarse sandpaper to make the patch blend into the surrounding metal. Don't smooth the surface.

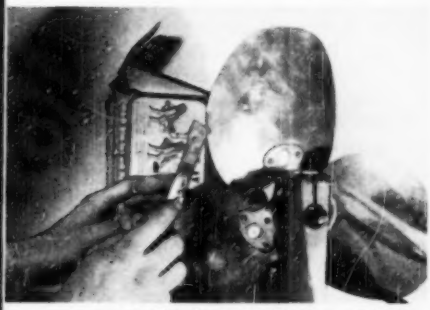
5. Apply several layers of the metal paste with a brush or knife till the patch has desired thickness. If paste is too heavy to use, thin it with solvent.



6. File and sand the new metal to a smooth finish. The patch will be practically invisible and should last as long as the cleaner itself in normal use.

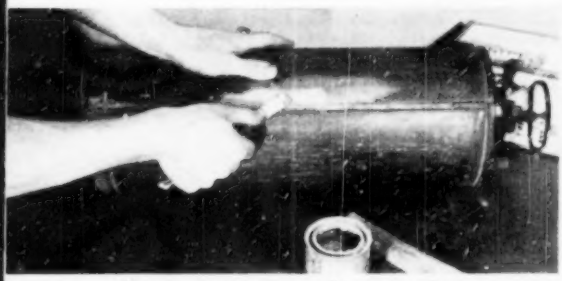
Here's What You Can Do

Boiling water won't affect this plastic-metal leak stopper.



Fan blades out of balance? Dabs of cold metal stick to aluminum.

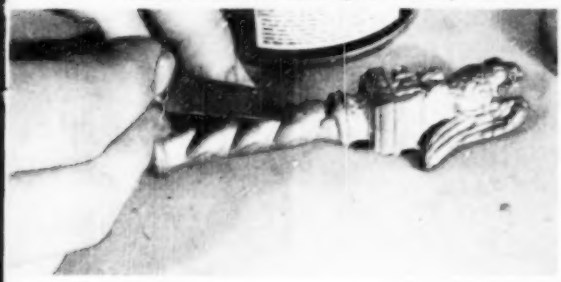
Durable, waterproof repairs take only a few minutes. Cold metal can be primed and painted like any other.



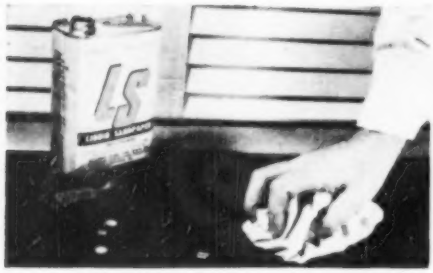
Pressure-resistant patch repairs plant sprayer.

Drippy watering-can spouts are quickly fixed.

Small defects in castings are easily mended.

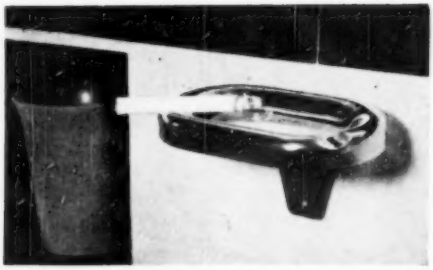


Farms have plenty of jobs for plastic metals.



Sandpaper in Liquid Form

NOT a paint remover, Liquid Sandpaper acts like a very fine abrasive paper. It cleans and prepares painted wood, metal, and plaster surfaces for refinishing. Applied with a cloth, a light wiping does the job instead of the hard rubbing you would need if you used sandpaper. On natural wood-grain finishes, the maker—General Liquids Corp., Baltimore—recommends that you use steel wool saturated with the product.

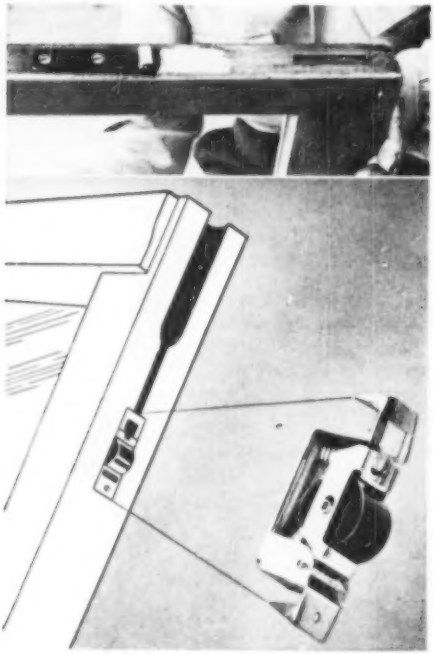


Ash Tray for Tile Walls

NO SCREWS, bolts, nails, or other fasteners are needed to attach this ash tray to any wall—tile, glass, wood, or metal. A plastic adhesive binds a clip to the wall. The removable ash tray fits on the clip. This method of attaching the tray is especially handy in tile-walled rooms—such as the bathroom. It eliminates drilling the tile. The chrome tray is priced at about $2 by Household Aids, Inc., of Rochelle Park, N. J.

Rollers Substitute for Sash Weights

BOTH of the easy-to-install gadgets pictured below take the place of sash cords and weights by pushing the window against the frame.



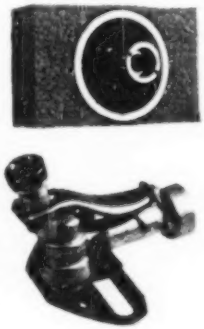
Top picture shows the Window Check, made by Paul C. Wells, San Diego, Calif. It's a roller on flat spring steel. Two screws hold it to the sash.

The Sash Snubr, made by Verb Manufacturing Co., Coffeeville, Kan., is shown in the drawing. It's a stainless-steel holder and spring that exerts pressure on a synthetic-rubber roller. It may be installed in the sash or in the window frame.

Both devices hold a window in any position, and both stop window rattles.

Double-Duty Hose Nozzle

SCREWED to the end of your garden hose, this nozzle serves as a lawn sprinkler or—with the sponge-rubber pad—as a car washer. Both are manufactured by Molded Specialties, Inc., of Cleveland, Ohio. As a car washer, it's a water saver. The instant you release pressure on the trigger, the water is shut off. If you want a constant stream—for lawn spray or other purposes—you just snap a lock ring over the trigger.



Clothes Washer for Camp Use Built Like Churn

THIS hand-powered washer is a natural for camps and other places that lack electricity and plumbing. You can make it in half an hour from scrap materials.

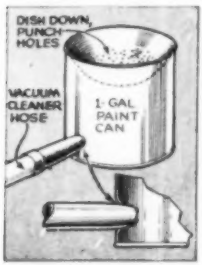
Cut a wood disk to fit loosely in the bottom of your biggest pail. Bore a dozen ¾" holes in it and nail on a pair of ¾" cleats to space it up from the pail bottom. Round off the corners of a square piece of wood, bore about four 1½" holes in it, and screw it securely to a short cedar pole.

To use, put the disk in the pail, add warm soapy water, toss in the clothes, and work the plunger up and down for a few minutes. *—Hubert V. Coryell, Pasadena, Calif.*

Screw Tightens Hose Clamp

FOR quick initial engagement, this hose clamp uses a hinge principle. When the screw is swung out, the free end of the clamp is inserted and pulled through finger-tight. Then, for fast take-up after the clamp is in place, the gear-type screw is tightened. The clamp may be installed before or after hose assembly. It's made in five sizes by the Actus Corp., Mt. Vernon, N. Y.

Vacuum Cleaner Blows Forge



FOR hammering out small pieces of hardware, you can assemble a satisfactory forge from a 1-gallon paint can and your wife's vacuum cleaner. Dish in the end of the can and punch it full of holes. Cut a hole in the side to fit the tapered end of the vacuum-cleaner extension hose. Place the hose close to the exhaust outlet of the cleaner adjusting the position for the air volume needed. Connect the hose directly to the outlet if you want a strong blast. Make a small fire with soft coal and charcoal.—*A. A. Abbatiello, Oak Ridge, Tenn.*

The Height of Ingenuity

Cleaning the bottom of my cabin cruiser was always an expensive operation until I hit on this method. Now, instead of hauling the boat out of the water, I clean the bottom while the boat is at anchor. What do you think I do?

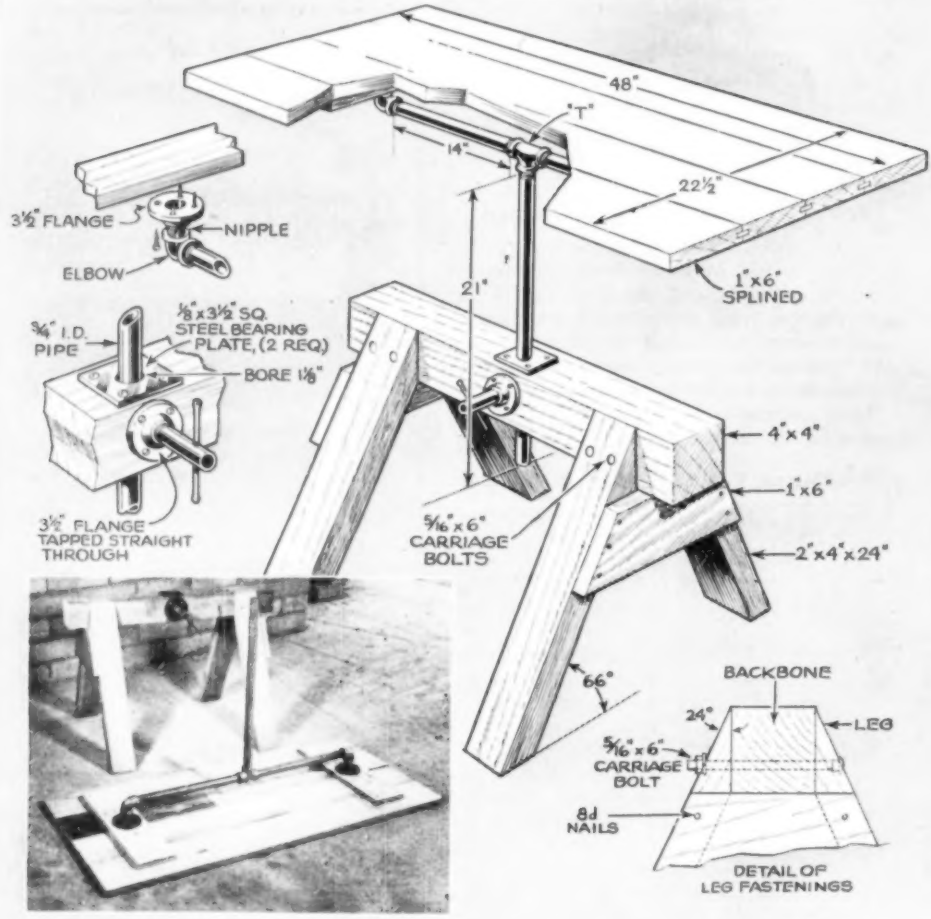
Across the top of a stiff-bristled, street-sweeper's broom, I lash a big, empty can. The can is tightly stoppered so no water can enter Then I climb into a small boat and scrape the bottom of the cruiser with the broom. The air in the can forces the broom up against the bottom of the boat.—P. C. Pfeiffer, Great Neck, N. Y.

Split Carton for Photo Tray

CUT lengthwise down along the middle, milk cartons will quickly provide you with a set of emergency photo trays for processing 2¼" by 3¼" or smaller contact prints.—*Isaac Frank Garcia, Manhattan, N. Y.*

Shop Table Handles Many Jobs

Table is easily portable for jobs indoors or out. At right, it's being used as a workbench for a screen repair and repainting job.



By Roland Cueva

HERE'S a sawhorse that's more than just a horse. You'll find it's a regular mule for work around your shop. The table top is adjustable in height from 27″ to 45″. A powerful pipe clamp holds it in position. With it set to bench-saw height, you can handle large work singlehanded. Or you can use it for a gluing and assembly table, an auxiliary workbench, for cutting patterns, painting, and wallpapering. Move it outdoors for back-yard barbecues. Or remove the top and you have a fine sawhorse.

Cost of materials runs about $6, including pipe and fittings. The lumber need not be new and is all standard size—one-by-six, two-by-four, and four-by-four. Start by gluing up four 1″ by 6″ boards 4′ long for the top. They should be splined or doweled together for strength. Two cleats are screwed to the underside of the top.

The backbone of the unit is the four-by-four to which the two-by-four legs are bolted. The top ends of the legs are cut to a 24° angle and the bottoms to 66°. A 1″ by 6″ gusset is nailed to each pair of legs.

Take care when drilling the 1⅛″ vertical and horizontal holes. These must be absolutely plumb or the table won't be level. The pipe must fit snugly in the holes in the bearing plates, yet must slide without binding. A welding shop made up the plates for the table pictured here for 50 cents.

The pipe flange that's screwed to the side of the four-by-four must be tapped through to remove the taper in the threads. A short piece of pipe—threaded on one end—and the ¾″ iron rod complete the clamp.

In your workshop, table is like extra pair of hands in handling long work. Here it's supporting one end of door that's being trimmed.

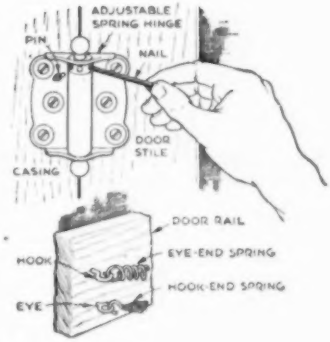
A plumbing shop can supply all the pipe and fittings for the underside of the table top. The flanges, nipples, and elbows are put together first. Then the two horizontal pipes are turned into the elbows. These should be 15″ long, including the threads. After these are turned into the T, thread the standard into the bottom of the T. Turn up all joints as tight as possible. The whole assembly then is placed on the underside of the table and the flanges screwed to the cleats. END

SCREEN DOORS

Screen and storm doors often do not close properly because their spring hinges lack the necessary tension. Hinges are adjustable for tension if they have holes around the collars. Insert a nail in a hole and turn the collar until the stop pin is freed. Replace the pin in a hole farther from the nail and allow the collar to turn back.

If the spring is broken or too weak, replace the hinge or install a screen spring inside the door, maintaining some tension even with the door closed. Be sure to turn the hook openings downward or inward to keep them from catching and tearing clothes.

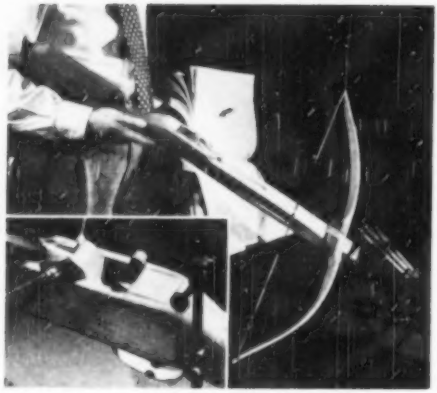
A spring installed at the top of the door helps if the upper corner is sprung. To remedy the tendency of old doors to bow, install an inexpensive butt hinge at the center



FOR YOUR POPULAR SCIENCE INFORMATION FILE

CRAFTSMEN AT WORK

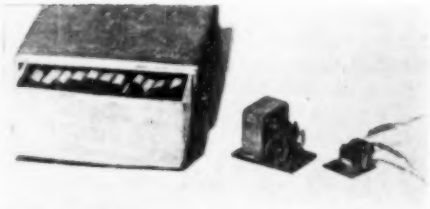
Prop Powers Rapids Crasher. Air power rockets this 16′ speedboat over the water at speeds up to 48 m.p.h. A light airplane engine and a paddle-blade prop furnish the push. The engine is flanked by an air rudder and a protective screen. L. R. Kauffman, of Grants Pass, Ore., built the boat to run rapids and navigate water too shallow for an outboard.



Crossbow Hits the Bullseye. This target crossbow shoots an arrow with enough force to rip through a thousand-page phone book. It was built by Tracy L. Stalker, of Flint, Mich., who has this to say about the bow's accuracy: "Shooting from a muzzle and elbow rest, I have repeatedly made 1-inch 3-shot groups on my 45-foot home range."

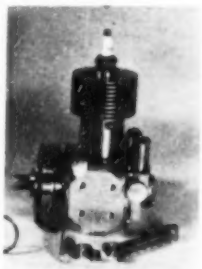
A special feature is a safety block that engages automatically when the bow is cocked. The bolt can't be fired until the safety is flipped to off position. The rear sight is adjustable for windage and elevation. No jack or other mechanical device is used in drawing the string.

The stock and lock mechanism are carved from walnut, maple, and mahogany. The bow is laminated from strips of osage orange, hickory, and maple.



Tiny Motors. Two new candidates for the title of world's smallest motors are pictured above. The mammoth object on the left is a penny matchbox. Johann Schoissengeier, of Karlsruh, in the U. S. Zone of Germany, made both motors. He reports that the larger one weighs 1/15 ounce and runs at 3,000 r.p.m. on 1 volt AC or DC. The smaller motor is said to weigh 1/50 ounce, needs ½ volt, and delivers 4,000 r.p.m.

Builds PS Engine. William Bowker, of Cedar Rapids, Iowa, built the midget gasoline engine pictured below. Bowker devoted about 350 working hours in a high-school machine shop to the job. It was made without castings, has a compression ratio of 15 to 1 and a speed of 13,000 r.p.m. The crankshaft is mounted on ball bearings. Plans came from PS of June, July, and August, 1946.



New KODAK SKYLIGHT FILTER—*Warm up your color scenes,* taken in open shade and on overcast days, with this new filter. (Requires no change in normal exposure.) Also decrease bluish cast in mountain and marine color pictures, snow scenes, distant landscape shots. Available in series IV, V, VI, VII, and VIII Kodak Combination Lens Attachment sizes, as well as in 2-inch and 3-inch gelatin film squares.

For regular black-and-white shots, you'll find the medium yellow KODAK FILTER K-2 just what the picture ordered. The K-2 puts the *right tone* in blue sky, pops up clouds, and cuts haze for *clearer* shots.

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And for the most dramatic shots of all, it's the red KODAK FILTER A. It darkens blue skies with a startling effect. And with *Infra Red Film* you'll get the most amazing pictures you ever saw—white foliage, black skies—terrific contrast!

Kodak Filters described above, in series sizes, from $1.60. See them at your Kodak dealer's.

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Gus Earns a Holiday
[Continued from page 173]

motor. "That gasket come with the block?" he asked.

"No, we bought that. Dave got it down at the crossroad service station."

"Mr. Littlefield," said Gus, "I think we've stumbled on your bum main bearing." He grinned as he picked up the gasket. "Got a sharp knife and a file?"

Puzzled, Ken and Dave watched the old garageman go to work on the gasket, as he carefully enlarged each hole that fits over the cylinders about a quarter inch. Then, putting the gasket back into place on the motor block, he said, "Now let's get that head back on and see what happens."

Still puzzled, Dave and Ken did as directed.

"Now start her up," said Gus when they had pulled the last bolt up tight.

Ken stepped on the starter and all three cocked their ears toward the hood. There wasn't a sour note. The engine purred. Ken raced it, still no noise. He idled her down, not even a tiny knock.

"Well, I'll be darned," exclaimed Ken as he switched off the ignition and slid from under the wheel. "Purrs as purty as a kitten. But I still don't get it."

"Frankly, I didn't get it either," admitted Gus, "until I saw that gasket. Then I knew you'd made the understandable mistake of not realizing that a regular size gasket doesn't always go well with rebored cylinders and over-size pistons. That gasket had just enough of a lip extending over the rims of the rebored cylinders to be hit by the pistons everytime they came to the top of their stroke. The result—a noise that sounded like a knock."

As Gus drove back to town late that night, he was pleasantly happy and pleasantly tired. He'd had good fishing, he'd had an extra-special dinner, and he'd been able to help the Littlefields out of a spot. What more, thought Gus, could he want? END

Ever Count Your Car Springs?

SOME modern cars contain more than 400 wire springs. One maker lists 265 in the seats, 16 on the engine valves, 11 in the carburetor, 8 in the clutch, and others in the door locks and handles, master cylinder, horn button, and other parts. The tiniest is in the carburetor. It's so small it takes 125 of them to weigh an ounce.

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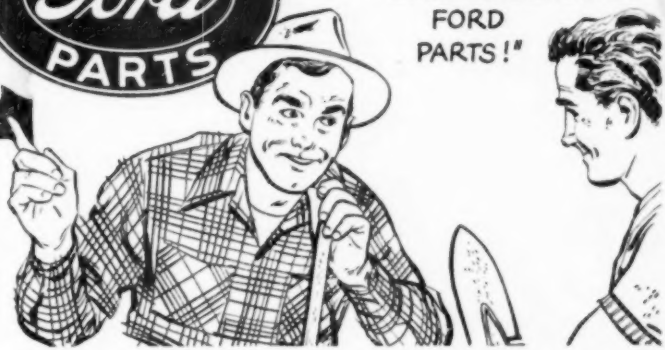
"THEY'RE MADE RIGHT TO FIT RIGHT TO LAST LONGER," HE TOLD ME "THEY KEEP YOUR FORD ALL FORD."

GENUINE Ford PARTS

"IF ALL FORD OWNERS KNEW HOW MUCH TIME, MONEY AND SATISFACTION THEY GAIN — THEN THEY'D ALWAYS SPECIFY GENUINE FORD PARTS!"



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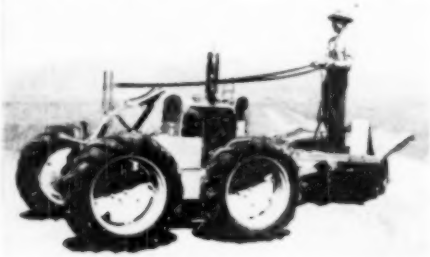
Mechanics of Farming

By Ladd Haystead

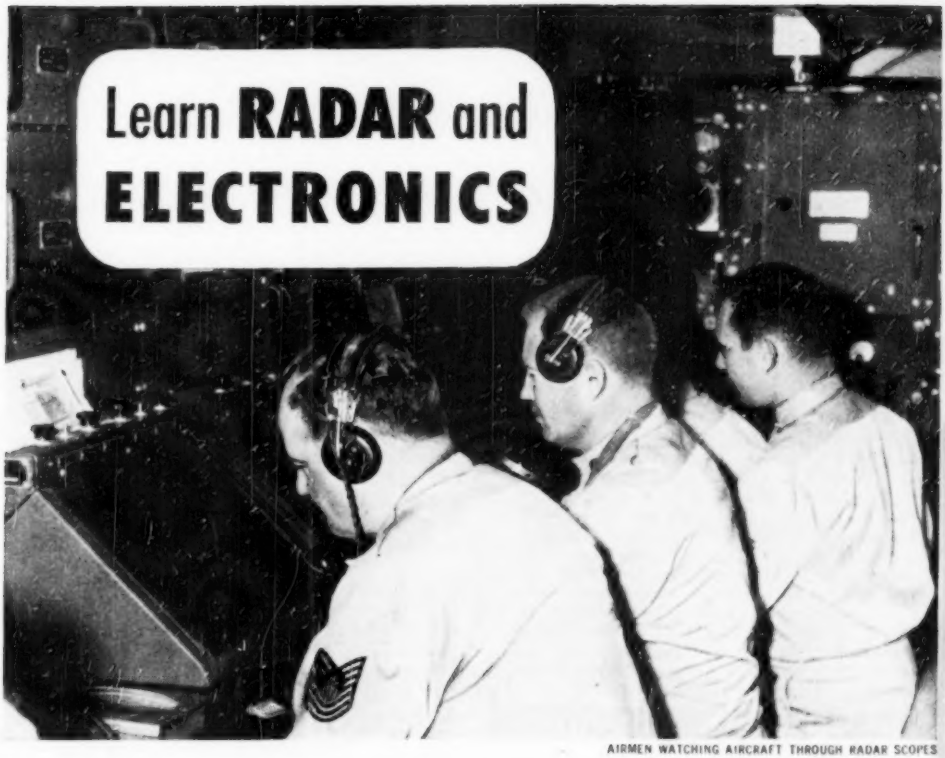
■ Rotary tillage has interested agricultural engineers for over a generation because this method of seedbed preparation does all necessary operations in one pass over the ground. However, one drawback has limited the market largely to home and commercial gardeners--the rapid wear caused by the shock of the spinning tines hitting stones and other obstructions. Cushions, slipping clutches, rubber bumpers, and shock absorbers of various designs have been tried out with some success, but not with entire satisfaction. Now, from Rototiller, Troy, N.Y. comes a substitute for the tines --a solid, shockproof cutaway disk.

■ A new four-wheel-drive tractor, the Power Horse, with the pulling power characteristic of a track-type tractor, is announced by the National Implement Co., New York. Instead of a steering wheel, it has two handles that make it possible to ride on a drawn implement or wagon, as shown



in photo, and steer by reins as in driving a team. Machine is made in Stockton, Calif.

■ Dutch elm disease can kill a healthy tree in two weeks, and has decimated some of the most beautiful wooded sections of the East in recent years. A new drug, Carolate, developed by Prof. Frank Howard, of the Rhode Island Agricultural Experiment Station, promises a cure. The drug is a mixture of four chemicals to be spread on the ground under the trees and watered in. It neutralizes poisons that the elm fungus



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Mechanics of Farming

spreads into a tree's sap stream, and at the same time revitalizes the tree. It also acts as a preventative on the spread of the disease to uninfected trees.

■ Paper from southern pine is fast becoming the chief industrial product of the South. In 1950 the industry will employ 120,000 workers, pay over $100 million dollars to owners of small woodland tracts, mostly farmers.

■ Agricultural machines don't always succeed, reminds the Illinois College of Agriculture in reporting that stalk cutters thought to control the corn borer are failing at the job. After extensive tests of existing machines, it was found the best ones left 30 percent of the stalk uncrushed. That leaves plenty of places for the borers. Only clean plowing gives adequate control.

■ Hay can be put up the same day it is cut by using a new 'conditioner' anncunced by the Meyer Mfg. Co., Morton, Ill. While the power mower is cutting a swath, the row previously cut is picked up by a rotator and drawn through the conditioner, which splits the stems and aerates the material. Experiments, says the maker, show drying time is 30 to 50 percent less and carotene content up 300 percent.

■ American agriculture is the most mechanized, most efficient in the world. Yet, agronomists are worried over declining yields in many sections, due, it is believed, to decreasing stores of plant food. This means that the use of fertilizer, already several times greater than prewar, must go still higher. Machines don't make manure.

■ Although large commercial pea viners have been around a long time, no machine has been available for use on small experimental plots. Due to rapid changes in vitamin content and other quality characteristics, slow hand-harvesting methods have hampered experimental work. Now, the U.S. Plant, Soils, and Nutrition Bureau (Beltsville, Md.) has developed a small gas-engine machine that can thrash a 50-foot plot in 4 minutes.

Every Mechanic Needs a

Snap-on*

MIDGET WRENCH SET

for small assembly work

Set Contains These 19 Most Needed Wrenches

When you have small nut-turning jobs, lay aside those "too-big" tools and put speed, safety, and working convenience into your hands with this 19-piece Standard Midget set. You get a Nut Spinner, 2" and 6" Extension Bars, Ratchet, Plastic Grip Handle, Sliding Bar, Universal Joint, nine hexagon sockets (3/16" to 1/2") and three square sockets (1/4" to 3/8").

$17.75

Plus Local Sales Tax

*"Snap-on" is the trade mark of Snap-on Tools Corp.

SNAP-ON TOOLS CORP., 8062-D 28th Ave., Kenosha, Wis.
Please send me the 119-TM-B Midget Standard Set
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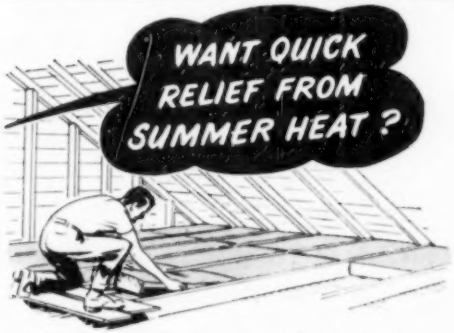

YOU can beat the hot weather by insulating your attic with Gold Bond Rock Wool Insulation. Lightweight, easy-to-handle Sealed Blankets or Enclosed Batts come in standard widths, fit snugly between attic floor joists or roof rafters. Fireproof...it can't burn. Keeps summer heat out, furnace heat in...pays for itself in fuel savings. Get Gold Bond Rock Wool Enclosed Batts in 2 ft. and 4 ft. lengths. Sealed Blankets are 8 ft. long. Be sure they're "full-thick"—and be sure they're Gold Bond for best results. Write for free booklet to Div. Y, Dept. PS-7.

Available at your local Gold Bond lumber and building materials dealer!

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CHINA, TOYS, FURNITURE BOOKS AND LUGGAGE

It's transparent, waterproof, flexible and durable. Get a tube today.

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TRADE X·F MARK

SWISS PATTERN FILES of the BETTER KIND

for every type of precision filing

WHEN fits and tolerances resolve themselves into denominators of thousandths, the files used on the work must be right for precise filing. Nicholson X.F. (Extra Fine) Swiss Pattern Files are widely regarded as the finest you can buy. They cover practically every need of the tool, die, pattern, model, watch, clock, jewelry and fine-instrument maker.* Their accuracy and general high quality are outstanding in these primary essentials:

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UNIFORM TOOTH STRUCTURE—assured by most modern file-making machinery.

SOUND TEETH TIPS capable of high hardening—the result of cutting only after file blank has been ground and drawfiled to remove every trace of surface decarburization.

UNIFORM HARDNESS AND STRAIGHTNESS to aid long life and accurate filing.

**Illustrated above is the famous Nicholson kit of twelve assorted X.F. Swiss Pattern Round Handle Needle Files—pride of the hobbyist and precision craftsman. Plastic box, with bottom stand, is in beautiful orange-and-blue design. At good hardware stores everywhere.*

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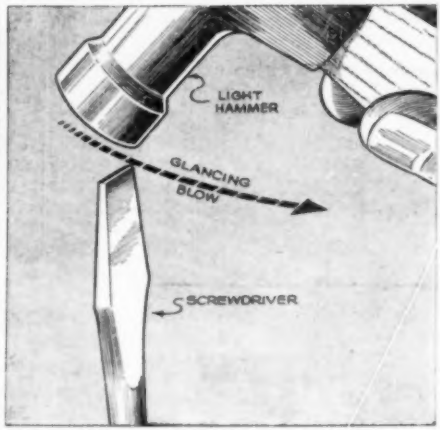
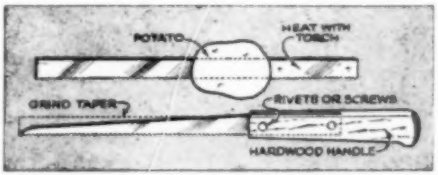
NICHOLSON FILES ***FOR EVERY PURPOSE***



Broadened Tip Grips Screws

You can put a gripper tip on a screwdriver in a couple of seconds. Knowing how may save your time and temper on many jobs. Select a screwdriver that is the right size and hold it with the tip up. Strike it a few glancing blows with a hammer, then turn the driver half around and repeat. This puts two sharp beads along the edge of the tip, giving it the gripping action you may need to get a screw into a difficult spot.—*Arthur R. Christensen, Lockport, N.Y.*



Saber Saws from Old Bandsaw

A HAND saber saw is one of the most useful tools you can add to your woodworking equipment. You can make one out of a discarded bandsaw blade.

Break the blade into 8″ lengths, and slip a raw potato over one end as shown. Heat the end in a flame until it turns cherry red. Let it cool slowly and drill rivet holes in the annealed metal. Shape the handle from a scrap of hardwood, slot one end for the blade, and rivet or bolt it in place. Then grind the back of the blade to a taper.

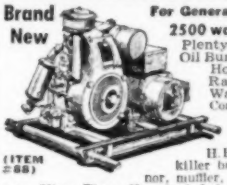
The potato is an effective heat shield. It protects the working part of the blade from heat and allows you to hold the free end without discomfort.—*Dick Hutchinson, El Monte, Calif.*

GROBAN'S WAR SURPLUS SPECIALS

ALL ITEMS BRAND NEW

AUXILIARY ELECTRIC GENERATING PLANT

Brand New



(ITEM #88)

For General Utility and Emergency Use

2500 watts—115 volts—60 cycles A.C.

Plenty of current to operate your Oil Burner, Sump Pump, Refrigerator, Home Freezer, Power Saw, Lights, Radio and Television, Home Water System Pumps.

Complete integrated heavy duty electric power plant, Signal Corps Model PE-75, driven by Briggs & Stratton one cylinder 6½ H.P. Model ZZ, 4-cycle engine with killer button, oil bath air cleaner, governor, muffler, starting rope, and radio interference filter. The self-excited Leland or Westinghouse generator is rated 2500 Watts, 115 Volts, 60 cycle A.C. single phase, belt driven, with guard and duplex receptacle. When generator is not in use, you can use the engine separately to power other equipment. Mounted on adjustable steel skids, notched for carrying poles. Net wt. 310 lbs. Shpg. wt. 440 lbs. Dimen. 36" x 19½" x 24". 12 month guarantee. $726.00 value. NOW F.O.B. Chicago **295.00**

UTILITY ROTARY VANE PUMP

Perfect For Water, Oil or Insecticides

(ITEM #51)

Sprays DDT, 2-4D, sulphur compounds, etc. Pressures to 150 lbs., 15 gals. per min. at 1200 RPM using 2 HP. As vacuum pump for milking machines, lab use, etc., delivers 29" vacuum, 4.5 cu. ft. per min. at 1500 RPM, using ¾ HP. Rotate either direction. ½" pipe thread ports. ½" standard shaft, 4 ball bearings. Easy angle bracket mounting—Ready to run. Shpg. wt. 13 lbs. ..... F.O.B. Chicago **$16.50**

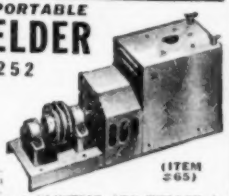
NEW! STATIONARY OR PORTABLE

D. C. ARC WELDER

250 AMPS. MODEL 252

FOR ANY WELDING JOB, LIGHT OR HEAVY

Stop Costly Repair Bills, Weld It Yourself and Save



(ITEM #65)

Designed for many years of trouble-free service. Handles anything from light gauge sheet metal to ½" plate. This precision-engineered Direct Current ELECTRIC ARC WELDER is offered at but a fraction of its original value. It can be mounted permanently or easily transported for portable use. Does the job instantly, where and when you need it.

The War Surplus generators for these Arc Welders were built by General Electric, Westinghouse, and Delco-Remy at a cost of over $900.00. They are light in weight; have oversized lifetime grease-sealed ball bearings; air-cooled commutator; dial type rheostat for easy pinpoint control; high-low range switch; reactor coil for even arc; handles 1/16" to ½" rods. Run welder at 250 R.P.M. from drive pulley or power take-off of tractor, a 7½ H.P. electric motor or a 10 H.P. gas engine. Use two V-belts, or flat belt (on pulley). Continuous welding rating—200 amps.; intermittent rating—250 amps.; 6-30 volts. Now ..... AT A FRACTION OF ITS VALUE. Price includes double V or flat belt pulley and instruction book. Ship. wt. 107 lbs. Only one or two jobs will pay for entire welder. F.O.B. Chicago **99.50**

ACCESSORY KIT including welding helmet, electrode holder, two 10 ft. cables with clamp and 5 lbs. of assorted welding rods. (ITEM #66) ..... F.O.B. Chicago **10.50**

Remember, Satisfaction is Guaranteed

G-1 Stainless Tank

(ITEM #63)

Use these tanks on compressors, for tire inflators, pulsation chambers, floats, buoys, hydraulic reservoirs, fluid and milk containers, fuel containers, etc. Tough, light, 450 P.S.I. Aviators Breathing Oxygen bottles, type G-1, 2100 cu. in. (approx. 9 gallons) int. vol. 24" x 12". ¼" threaded openings at ea. end. Wt. 19 lbs. F.O.B. Chicago. **4.95**

A. C. *LIGHT PLANT* GENERATOR

750 Watts 115 Volts 60 Cycles

(Item #67)

Manufactured by Elcor, rated 750 watts at 1800 R.P.M. Complete with voltmeter regulator; 1" shaft, with keyway for direct or belt drive, supported by two ball bearings. These units built to exacting Signal Corps specifications, are the answer to your lighting needs. Shipping wt. 60 lbs. F.O.B. Chicago **59.50**

Aircraft Quality HYDRAULIC CYLINDERS

Large supply of new labor-saving, economical hydraulic equipment in many types and sizes . . . including double action cylinders, control valves, tanks, pumps, fittings, hose, and data on hydraulic applications. Use these positive, highly efficient, smooth pressure hydraulics on presses, arbors, lifts, loaders, power control, positioning, brakes, plastic dies, auto frame alignment, etc., etc.

(Item #42)

ITEM #4—All steel double action hydraulic cylinder. 1½" bore, 2⅞" stroke. Clevis mounting. Will lift 1000 lbs. with 1000 P.S.I. line pressure. Perfect for positioning and feeding movements. Shpg. wt. 4 lbs. F.O.B. Chicago **4.95**

ITEM #33C—Double action hydraulic cylinder, 1½" bore, 4½" stroke. Clevis mountings at both ends. Uses ¼" pipe fittings. ..... Postpaid **8.95**

ITEM #32—Double action, 1½" bore, 9" stroke, will lift 1760 lbs. with 1000 P.S.I. line pressure. Wt. 4 lbs. A $45.00 value. Postpaid **10.95**

ITEM #41—Double action hydraulic cylinder, 2" bore, 6" stroke, clevis mounting at base and end of shaft. Overall length closed 12½". Has ¾" stainless steel shaft, uses ¼" tubing fittings. Will lift up to 3100 lbs. with 1000 P.S.I. line pressure. Weight 7 lbs. Postpaid **12.50**

ITEM #16—Double acting cylinder, 1½" bore, 27" stroke. (Will lift 1760 lbs. with 1000 P.S.I. line pressure. Wt. 8 lbs.) A $55.00 hydraulic cylinder value for only Postpaid **12.95**

ITEM #15—Double acting cylinder, 3" bore, 8½" stroke. All steel hydraulic cylinder, will lift up to 7000 lbs. with 1000 P.S.I. line pressure. Wt. 12 lbs. A $78.00 value. Postpaid **19.50**

ITEM #31—Double acting cylinder, 3½" bore, 11" stroke. Will lift 9600 lbs. with 1000 P.S.I. line pressure. Wt. 15 lbs. Postpaid **22.50**
A $92.00 value

ITEM #40—Double action, 3½" bore, 20" stroke. Rated lift capacity 9600 lbs. with 1000 P.S.I. line pressure. Clevis mounting, aluminum alloy barrel with ¼" stainless steel shaft and piston. Wt. 20 lbs. $125.00 value F.O.B. Chicago **25.00**

ITEM #42—Double action hydraulic cylinder, 4" bore, 18" stroke. Rated lift capacity with 1000 P.S.I. line pressure is 12,500 lbs. Ship wt. 30 lbs. F.O.B. Chicago AN EXCELLENT BUY for **32.50**

HI-PRESSURE FITTINGS for cylinders and valves available at 35c ea. for ⅛" pipe and 50c ea. for ¼" pipe.

PUROLATOR OIL FILTER

PERMANENT TYPE

The perfect oil filter to keep your motor oil or hydraulic fluid clean at all times. Protect your motor or engine with this unit. Just turn the handle and the element is clean. Standard ¾" inlet and outlet ports to accommodate 12 gallons per minute. Shipping wt. 4 lbs. A $12.00 value. (ITEM #70) Now ..... **4.95** post-paid

DIRECT CURRENT GENERATORS

For welders, plating, truck and marine use, D.C. appliances, lights, etc. Aircraft quality—lifetime grease sealed ball bearings. Heavy duty.

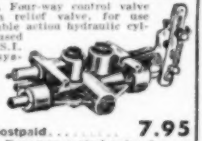
Item #89—Type M-2, rated 50 Amps.—24 Volts. Mfd. by Leece-Neville Co. Shpg. wt. 32 lbs. Gov't. Acq. Cost $176.00. F.O.B. Chicago. NOW ONLY **16.50**

Item #90—Type P-1, rated 200 Amps.—28 Volts, 2500 RPM. Mfd. by General Electric, Ford, Delco-Remy and Westinghouse. Gov't Acq. Cost $300.00. Shpg. wt. 54 lbs. F.O.B. Chicago **22.50**

Item #91—Type R-1, rated 300 Amps.—30 Volts. Mfd. by Jack & Heintz. Gov't. Acq. Cost $380.00. Shpg. wt. 70 lbs. F.O.B. Chicago **35.00**

Each individually packed in wooden box.

HYDRAULIC CONTROL VALVE



ITEM #24. Four-way control valve with built-in relief valve, for use with one double action hydraulic cylinder, may be used with 1500 P.S.I. hydraulic system to open and close hydraulic cylinders. Ship. wt. 8 lbs. A $28 value, postpaid **7.95**

ITEM #26. Four-way control valve for use with two hydraulic double action cylinders. Each cylinder may be operated independently of the other or in conjunction with the other. Oil may be locked in any of the cylinders to hold the piston at any required position. Ship. wt. 6 lbs. A $60 value. postpaid **10.95**

VICKERS HYDRAULIC TRANSMISSION

(ITEM #85)

MODEL AA16801A

Ideal for lathe drive, miniature cars, power machinery, gearing, etc. Rated 2 HP maximum input at 3750 RPM. Output speed continuously variable from 0 to ⅛ of input speed in either direction. Self contained reservoir. All controls external. Even power at all speeds. Complete with two ½" shafts with flat for pulley attachment. Shpg. wt. 20 lbs. Gov't acquisition cost $325.00. A tremendous value at F.O.B. Chicago **25.00**

LOGAN HEAVY DUTY HYDRAULIC PUMP

(Item #29)

For operating hydraulic cylinders and hydraulic motors on tractors, bulldozers, construction machinery, lift trucks, industrial applications, etc. Delivers 8 GPM at 1500 RPM at 1000 P.S.I. using 5 HP. Has ½" pipe thread ports. ¾" shaft with flat and keyway for direct or pulley drive. Has flange, with 4 bolt holes for convenient mounting. Ship. wt. 22 lbs. Overall dimen.: 7" L x 5½" H x 9½" W. A $165.00 value FOR ONLY ..... **22.50** F.O.B. Chicago

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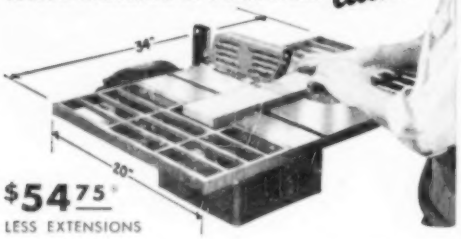
FREE: NEW 44-PAGE CATALOG listing excellent War Surplus values including generators, welders, pumps, hydraulics, and data on hydraulic applications. Write for yours today!

New POWER KING
8" TILT/ARBOR
BALL BEARING SAW

A New Standard of Value from Atlas



$54.75*
LESS EXTENSIONS

Has the capacity you need for any type of construction for your home. Cuts 2⅝" deep. *Precision-ground grey-iron* table, *full-length* rip fence, *tilting/arbor, sealed ball bearings.* *Price, F.O.B. Kalamazoo, less motor, extensions, only $54.75—$67.75 with two extensions as shown. Send a postcard for new catalog.

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Atlas
Atlas POWER KING

KING MIDGET
HOME ASSEMBLED AUTO

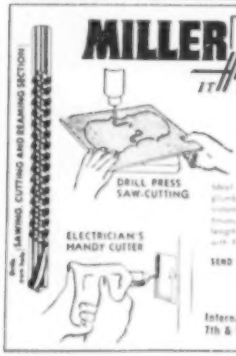
WORLD'S LOWEST PRICED AUTOMOBILE!
80-90 MI. PER GAL.—45-50 MI. PER HR.

Drive for as low as 50¢ per week. Precision built parts direct from factory with beautiful all steel body. Get the facts on this amazing small auto—send 25¢ for detailed circular with large picture. A class drawing—not some of all parts—or send $1 refunded 1st order—for this plus actual scientific book with 42 photos. Histories, blueprints of show, tow conversions, information on mini-midget racing, etc.

King Midget is ideal for errands, sports use, to work, short business or pleasure trips, or second car utility for the whole family. Also tops for mini-midget racing. Room for six footer.

MIDGET MOTORS MFG. CO., Athens 3, Ohio

MILLER ROTARY
HI-SPEED ROPE-SAW DRILL-BIT
IT SAWS CUTS REAMS



SAWS, CUTS, REAMS sheet metal, angle iron, pipe, wood, plastic, linoleum, etc. Amazing high speed combination for one low fee, any 1" or 4" electric drill or slow drill press, takes place of up to $50 in tools. Drills own starting hole to quickly cut saw in room opening. Easy to operate. Ideal for carpenters, auto mechanics, electricians, plumbers, hobby workers, many others. Advanced version high speed steel drill withstand severe conditions, use 1" diameter, overall length 31", tubing section 7" long with flutes ground from solid.

SEND CASH, CHECK OR M.O.

PRICE $3.95 POSTPAID

Order Now

International Twist Drill Corp. Room 695
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New Kind of Cloth Made Without Weaving

After dinner, throw away your tablecloth and your napkins. And do the same with apron and dishcloths when the dishes have been dried. They're made of a new kind of cloth so inexpensive that they can be used once and then thrown away. The same material now yields expendable handkerchiefs, towels, dust and polishing cloths, babies' diapers, and decorative draperies.

These are only a few typical applications of the new "nonwoven fabrics," probably the most radical innovation in the history of textiles. Since the making of fabrics began, fibers have always been fashioned into cloth by the time-honored art of spinning and weaving—with wool felt, made from sheep's wool, being virtually the only exception. Other fibers lack natural characteristics that make those of wool intertwine, "felting" or interlocking and thus permanently bonding them together.

Today, however, artificial bonding by chemical and other means, dispensing with mechanical spinning and weaving, can create unwoven fabrics from fibers of any type—both natural and synthetic. Cotton and viscose rayon have been the materials most widely used to date. But the process is said to be equally successful with others, including acetate and Vinyon.

Fibers for unwoven fabric are first formed into a "lap" or sheet, using either textile- or paper-making machinery. Liquid plastic is then added to the sheet, binding the fibers together in one bonding process. The plastic may be applied by dipping, spraying, or printing with rollers, sometimes in parallel strips or in other decorative patterns. Another process uses blends of fibers, some of which are softened by heat to serve as a binder, with or without the supplementary aid of a chemical bonding agent. Drying, which may be done on heated rollers, follows bonding. All steps are well adapted to economical mass production.

Bonded, or nonwoven, fabrics have the feel of conventional cloth. They may be made soft or stiff, absorbent or water-repellant, as well as flame-resistant, as desired, and can be attractively dyed or printed in colors. They resemble either cloth or paper in appearance, depending on the process of manufacture, and are far more durable than paper in towels and napkins. Makers are

DREMEL'S STRAIGHT-LINE ACTION

GUARANTEES SCRATCH-FREE SURFACES

Here's fast cutting, finish sanding at its best. Dremel introduces a new electric sander, sturdily built to withstand hours of continuous use. It is light in weight . . . will not tire operator. Its **straight-line (non-rotary) action** leaves no scratches, no rotary marks—just satin-smooth surfaces ready for any type finish. Here, for the first time, is an electric sander built for years of faithful service—all at the remarkably low price of **only $24.50.**

A POWERFUL, FAST CUTTING TOOL FOR CRAFTSMEN, HOME and INDUSTRIAL USERS

Craftsmen find this new Dremel model has the extra stroke and power needed for heavier woodworking projects such as cabinet-making, boat building and refinishing, garden furniture, etc. Home-owners say it's just the tool for preparing surfaces for painting and varnishing—for refinishing walls, woodwork, furniture, dry wall joints, siding and other surfaces. The Model 2000 also does a professional job of polishing waxed surfaces—eliminating all the back-breaking labor on cars, furniture, floors, stairways, etc. Industrial users likewise find this new Dremel Sander a faithful performer in furniture, cabinet, building and body shop operations.

RUGGED DESIGN and PERFORMANCE FEATURES

- Only two moving parts—requires no oiling.
- Reciprocal (straight-line—non-rotary) action leaves no marks . . . cannot burn surface.
- 21 square in. sanding surface speeds production . . . 14,400 cutting strokes per min.
- Cam-type holder permits changing paper in seconds.
- Die-cast aluminum housing with moulded Bakelite cover . . . Light weight, only 5 pounds. Over-all size 3½" wide, 4½" high, 7" long.
- 8 ft. Underwriter's Approved cord . . . uses 110-120 v. A.C.

PRICE INCLUDES STURDY CARRYING CASE

Perfect portability of Sander, cord, abrasives, and polishing pads is provided in this sturdy, 3-shelf metal storage case. Price also includes 25 assorted sheets abrasive paper and a high-grade sheepskin polishing pad.

DREMEL Model "1" SANDER-POLISHER OVER 200,000 NOW IN USE!

A lighter-capacity Sander that takes all the work out of home or hobby projects. Popular with women for polishing furniture, etc. Same design and construction features as larger model. Furnished in attractive cardboard box. If your dealer can't supply, order direct from factory. $14.95

DREMEL Electric COPING SAW

CUTS SCROLLS LIKE MAGIC—SANDS AS IT SAWS

FREE PROJECT PLANS . . . for 6 useful projects packed with each saw

SAFE! AS A HANDSAW

For home, hobby, repair work—no other tool pleases so much for so little cost. Works in any direction—delivers 7,200 strokes per minute smoothly, effortlessly. Saws through ¼" medium-hard wood at a foot-a-minute speed. Touch-of-the-trigger, foolproof action. Only 2 moving parts, never needs oiling. Uses 110-120 v. A.C.

MOTO-TOOL—THE POCKET-SIZE MACHINE SHOP

Don't confuse M-to-Tools and Accessories with so-called "bargain offers." Compare Dremel feature for feature with competitive tools. If our products are not superior in every way, we don't want you to buy.

MOTO-TOOL KIT NO. 2 With 20 Accessories (High Speed Steel Cutters, Grinding Wheels) **$23.50.**
MOTO-TOOL NO. 2 (only) with one emery wheel point **—$16.50.**

Moto-Tool is the most versatile tool you can own—grinds, routs, drills, carves, engraves, polishes, etc. **Look at these features:** Approx. 27,000 R.P.M. ● Dynamically balanced armature eliminates vibration. Oilless (oil-sealed) bearings ● Dust-filtered air-cooling system ● Weighs 13 oz. ● Uses 110-120 v. AC ● Used in plants of General Electric, Ford, Remington Arms, Nash-Kelvinator, etc.

Portable DRILL PRESS

Only $9.95 (Less Moto-Tool)

WHERE TO BUY DREMEL TOOLS

Dremel Tools are sold everywhere. If your dealer cannot supply you, send remittance in full and we will ship postpaid. Or send only $2, and pay postman balance plus postage and fee. **Money back if not delighted after 5 days' trial.**

DREMEL MFG. CO., Dept. 120-G, RACINE, WIS.

SeMaCo Dependable

AUTOMATIC SAW SET

Sets 400 teeth per minute on hand or band saws 4 to 16 point. Hammer and anvil action sets teeth accurately and uniformly . . . No tooth breakage. Does a perfect job. Used profitably by saw shops everywhere and saw manufacturers. Every machine guaranteed!

FAST · ACCURATE · DEPENDABLE

★INCREASES PROFITS

BEAVER MFG. CO.

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ARC WELDING FOR PROFIT OR PLEASURE

60 LBS. OF READY MADE PARTS Only $24.95

BUILD YOUR OWN HEAVY DUTY WELDER SAVE BUY ONLY NECESSARY PARTS

All parts Ready-Made and easy to assemble. You can do all around welding on steel, cast iron and other metals after only a few hours practice. Illustrated Instruction Manual included. Sold on 30 Day Money-Back Guarantee!

FREE: Write today for fully illustrated Pamphlet S-7.

Gives 100% penetration. Welds are stronger than original metal. Operates on 110 or 220 AC

ATOMIC ARC WELDER CO.

1039 So. 19th St., OMAHA, NEBR.

PESCO HYDRAULIC PUMP

With built-in adjustable relief valve. This brand new, powerful gear-type pump is rated at 1000 PSI, 8 G.P.M. at 3750 R.P.M. Delivers up to 6 H.P. Requires 1/2 to 6 H.P. to drive directly. 1/2" drive spline and 3/4" pipe ports. Weight approximately 7 lbs. Priced at only **$8.95**
Discounts on quantity.

HYDRAULIC CYLINDER.

Oil or air double acting. 1 1/2" bore, 4 1/2" stroke. Lift 2000#. Weight 4 1/2#. Priced at only $4.95, when purchased with above pump, which will run one or more of these cylinders. If purchased without pump, priced at **$6.00**
Discount on quantity.

HIGH SPEED MILLING CUTTERS

Dia.	Width	Arbor Hole	Price Ea.	Quantity
SIDE MILLING CUTTERS				
2	1/8	5/8	1.20	6/$6.00
2	3/16	5/8	1.25	6/$6.00
6	1/4	1 1/4	7.00	none
PLAIN MILLING CUTTERS				
1-1/4	1/8	5/8	1.00	none
2	1/4	1	1.00	none
2-1/2	2	1	3.50	6/$16.00
3-1/4	7/8	1	3.00	6/$15.00
4	1/4	1 1/4	2.95	6/$14.00
STAGGER TOOTH CUTTERS				
4	1/2	1 1/4	3.00	6/$15.00
6	5/8	1 1/4	5.95	6/$25.00

10 High Speed Morse Taper Shank Drills up to 1". New and slightly used surplus, $40 value for only **$6.25**

All merchandise sold with money-back guarantee of satisfaction and is shipped postpaid.

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EASILY... QUICKLY!

No experience needed. Follow simple instructions, weld on iron, steel, bronze, brass, aluminum, and other metals. Plugs into any properly wired 110 volt A.C. or D.C. line. Make or save time and money doing repair work for yourself and others. Repair men, farmers, tinsmiths, home and auto owners, hobbyists, etc., say FOUR-WAY pays for itself over and over. Order today or send for Free details.

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9" to 16-24" Lathes — 14" Drill Presses — 7" Bench Shaper

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BUILD YOUR OWN TILTING ARBOR SAW!

SAVE $50 OR MORE

- 27x28 in. table stays level. Blade tilts full 45 degrees.
- 10 in. blade cuts 3 1/4 in. deep, jackscrew depth adjustment.
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- New Departure ball bearing arbor, 1/4 in. precision shaft, ready to run, 5/8 in. bore blades.
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- Sturdy wood, steel and aluminum construction.
- No machining—build easily with hand tools only.
- Capacity and performance of floor saws selling for $150.00 and up!!

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GIL-BILT Metal Parts Kit includes Plans, ball-bearing arbor, cast aluminum miter fence and bar, rip fence guide, machined lock knobs, jackscrew mechanism with 4 1/2 in. handwheel, and all other metal parts including every screw, bolt, nut and washer (less blade) $20.95
Same Kit with 10" combination blade 24.90
Same Kit with 8" combination blade 23.90

Return kits in 10 days for refund if not satisfied.
(Prices include postage up to 400 miles)

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GILLIOM POWER TOOLS P. O. Box 1-VG, Lambert Field St. Louis 21, Missouri

seeking further to improve their strength, which does not yet compare with that of woven cloth—no drawback, however, in uses not requiring rugged wearing qualities.

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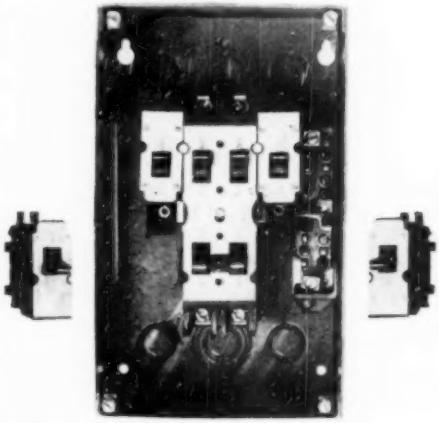
After I had bought a new set of golf woods, the pro let me in on a little trick. Rub the clubs with a little shoe polish and they'll retain their original luster.—*Arthur Kloth, San Francisco.*



Add-on Circuit Breaker

Flexible protection for home electrical circuits is provided by the Ad-On Multi-Breaker shown above. The units combine thermal and magnetic action to open an overloaded or shorted circuit. Hundreds of combinations can be provided in the basic installation to allow for a variety of current-handling needs and additional breakers can be added at a future time. This permits the expansion of electrical circuits without alteration of the original installation. Cutler-Hammer, Inc., Milwaukee, makes the circuit breakers.

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2500-WATT, 110-VOLT, 60-CYCLE

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BRAND NEW with original spare parts and tools

Kit contains — gaskets, ignition parts, spark plugs, valves, rings, wrenches, wheel puller, pliers, etc.

Cost Gov't over $600

$269 FOB Lincoln Nebr.

Or we'll ship Frt. Ppd. in U.S.A. $279

Limited number used plants excellent condition guar. $225 FOB Lincoln, Nebr. $235 Ppd. U.S.A.

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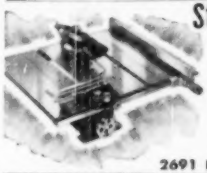

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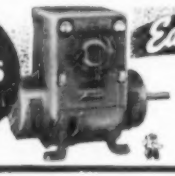

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CUTS 1-3/16", or 2 x 4 by turning over

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2 MAN

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U.S. AIR CORPS RUBBER BOATS

Another necessary item for your summer or fall vacation. These AAF rubber boats have been fully reconditioned and are ready for immediate use. Comes complete with carrying case. Safe and lightweight. For fishing or fun.

1 MAN **16.95** (with OARS) 2 MAN **24.95** 5 MAN **29.95**
7 MAN **42.50** PUMP **2.95** OARS **2.95**

"MAE WEST" Pneumatic LIFE JACKET

A MUST for the Fisherman, or Boat Owner. Why Take a Chance? BE SAFE! Can be inflated by mouth or sparklette bottle charge. . **2.49**
Extra CO_2 Charges 2 for 25¢

DIVING MASK

There's fun, thrills, excitement in exploring beneath the surface of the sea, the bottoms of rivers and lakes, when you can see these sights with your own eyes. Use this soft rubber diving mask with the big heavy duty glass eyepiece. Adjustable head band. Comes in 3 sizes. . .

Jr. 4½" **1.59** Miss 5" **1.89** Mr. 5½" **2.95**

SWIM FLIPPERS

For fun and frolic in the water, there is nothing better than Swim Flippers. Made with top quality rubber. Has pebble tread bottom, adjustable heel strap. Vented for air and drainage. . . . . **5.95** PAIR

FISHING SPEAR

Just the thing for fishing in ocean, streams and lakes. Corrosion resistant. 11" long, with barbed end. Diameter of socket 1". Get it! Use it! **39¢**

DIVING UNIT

DV-1

Study life under water! Fish and explore ocean depths with this divers unit. Complete with air supply tank, regulator and hose. Can be used for dives down to 25 ft. depth. Will stand 400 to 500 P.S.I. with enough air supply for approximately 12 to 15 minutes per dive. **5.95** DV-1

C-1 Air STORAGE TANK – A days supply for your diving unit. 12½" x 24". 500 lbs. pressure. . . . **4.75** C-1
This stainless steel tank can be used on Beach or carried in luggage compartment of car.

AIR TANK HOSE
This hose is used to top C-1 storage tank. To refill Diving Unit Tank. DV-1 Only... **1.59**

SEE OPPOSITE PAGE FOR ORDERING INSTRUCTIONS

SAVE UP TO 85% IN WAR SURPLUS from "GADGETEERS" HEAVEN

92 PAGE CATALOG
War Surplus — Tools, Machinery, Raw Materials, Clothing, etc. Illustrated with valuable info., tables, charts & data. Send 25¢ to cover hndling. & postage.

ANTENNA REEL
Just the thing for tuning beam antenna, Powered by 1/8 H.P. 24v G. E. Motor. Removable 6" Reel-limit Switch - Cam Worm gears, Bevel gear. Solenoid clutch. Motor engaged to gear reduction only when electrical contact made. Operates in either direction. Ideal for auxiliary power take-off, opening and closing doors, etc. #711 **4.29**

16 mm MOVIE CAMERA
Has semi-telephoto 1 3/8" (35mm) lens with yellow filter — 3 shutter speeds: for normal (16 frames) semi-slow motion (32 frames) and slow motion (64 frames per second). Uses any standard Eastman film magazine or Type 'G AAF magazine. Takes Black & White or Full Color pictures. Operates on 24V (dry cell batteries) & requires slight conversion for hand use. Diagram furnished. Cost Gov't $235.00. NOW **$24.50**
CONVERTED GUN CAMERA — Fully reconditioned with start switch on front. Choice of finishes — Grey, Black, Blue. **$33.95**

TANKS TO YOU!!
TANK Made of Dural. Has welded seams, 2" filler with cap, and two standard pipe ports for hook-up. Visible liquid level gauge on one side. An ideal tank for Gas, Oil, water or as a 'spare' on your auto, tractor, truck, boat or plane. Sturdy—Lightweight. **4.95**

Sleeping Bags
MUMMY BAG Has outer cover of forest green, water repellent balloon cloth. Filled with 15% Duck Down and 85% Chicken Feathers. ¾ length zipper. Size 34" x 84". **12.95**
KAPOK BAG — Here's real warmth and comfort. Has special water-repellent, olive green, heavy duty cover. Filled with 4 lbs. of 100% imported Kapok. Stays soft — will not mat down, 3/4 length zipper. Head flap makes dust cover when rolled. Full length mattress pocket. Size 34" x 77". **13.50**

NEW TANK
Aluminum tanks for auto, boat, trucks. Holds 19 gallons, weight 17 pounds. Size 18" x 13" x 25". Complete with Filler Cap. ONLY . . . **6.95**

MICROPHONE
Telephone type— Highly Sensitive with excellent, clear tone. This was the Signal Corps favorite. An ideal instrument for the radio "ham" and professional recording studio, broadcasting, home recording, public address, etc. A Sensational Buy! Complete with cord and plug. . . . ONLY **2.29**

PARACHUTES (CANOPY)
Ideal for shirts, Lingerie, Blouses, Car Covers etc. Each canopy is 24 ft. diam. approx. 50 sq.yds.. RAYON or SILK **9.95** NYLON **14.95**

U S NAVY INSULATED OFFICER FOOD CONTAINER
Why bother cooking on that trip? This lightweight plastic Thermal Food Container holds enough hot, fresh food for 8 people. Has 2-5 qt. removable Pyrex Baking Dishes for meat, veg. or liquids, 1-9 qt. Plastic container for ice, etc. Each section individual — Case of sturdy plastic with carrying handle. **10.95**
OPEN CLOSED

Jeep WATER TANK
Every motorist, boat owner should have one. Made of heavy gauge steel, screw top, porcelain lined. 5 gal. **Only 2.45**

NAVY PHONE SETS
Used by the Navy for Flight Deck & Gunnery Control. Each set is complete with 2 phones on chestplate, 2 headsets, button switches & 35 ft of cable. SET IS FULLY SOUND POWERED & can be successfully used up to 1/2 mile distance without battery. Ideal for home-to-garage, house-to-barn, office-to-shop, etc. Worth many times our price. Set of two . . **7.95**
Same as above with 2 flashlight batteries for power. Set of two . **7.25**

NYLON FISHLINE *Special*
Strong — Lightweight — 2 ply NYLON FISHING LINE. ROT-PROOF and WATERPROOF . . . Especially treated for strength and long life. ON SPOOLS.
35 lb. test, 1000 ft. green $1.59
50 lb. test, 400 ft. green. . . 1.19
72 lb. test, Braided, Black with Grey, 300 ft. 3.49
100 lb. test, 300 ft. white . . 3.79

New SUN VISOR
17½" x 6". Made of clear grn plastic. Adjustable arm & swivel head. Holds firmly. Can be swung in any direction. Made for the Air Corp. Very useful on your Car, Tractor, Truck or Boat. SPECIAL **1.29**

NEW TARPS - HEAVY CANVAS
Mildew & Flame Resistant. Cheap Outside Storage. They are Really Moving at These Prices.
9' x 16' $11.95 ea
5' x 7' **$3.95**
16' x 32' $39.95
9½' x 10' **$8.50**
16' x 22' $29.95
Rubberized Linen Tarps 7' x 11' NEW $5.95
Only 3 lb. light weight yet waterproof Ideal for outside car storage.

FOAM RUBBER
Molded & pre-shaped. Can be cut to fit your Chair seat, Boat, Auto, Truck or Trailer Seats. Ideal for all Sports Events.

4½" x 18" x 22"	$5.65
4" tprd. to 2½" x 22" x 23"	$4.95
4½" x 15" x 16"	$4.95
25" x 62" x 1½"	$6.45
25" x 65" x 2"	$8.45
25" x 65" x 1½"	$7.45

New Navy Boat Fender
Here's a Real Buy! Ball type fender made of special woven Coir rope in India. Rotproof & mildew resistant. Size of ball 15". Ideal for Yachts, fish boats & tugs. **2.95**

16 POCKET VEST
Sturdy, Yet Light Wt. Satin Lined with Tie Straps, 14 Outside Pockets, Plus Knife, gun, or Tool, Leather Holder, 2 large 11" x 8" Pockets Inside, Wonderful Hunting, Fishing, or Mechanic. A Steal **$2.49**

PLEXI DOME
Overall length 21" - Width at widest point 11" - at base 4". 6" deep. For Fish & Flower Bowls - Cab Roof - Lights. **1.89**

AIR CORPS BRIEF CASE
This is a genuine piece of AAF equipment. Made of best grade Brown Leather in a handsome Pebble finish with a light canvas liner. Has two full length map or paper compartments and three smaller pockets. An ideal case for students, salesmen, artists, etc. Full heavy duty zipper closure. 12" x 16". Shpg.Wt. 3 lbs. ONLY **2.95**

LEATHERETTE
to cover Chairs, Patio Furniture Nooks, Auto Seats, etc. 10 colors at a BARGAIN PRICE.

WIDTH	COLORS	PRICE (per run yd.)
36"	Grey, Brown, Black	$1.19
36"	Lt. Green, Dark Green, Blue	1.65
54"	Red, Grey, Lt. Blue, Ivory Yellow	1.89

HUNTING KNIFE
6" polished vanadium blade handle, leather grip, In leather sheath. $5.98 Value for ONLY **1.69**
With Parkerized black Finish **1.49**

PLASTIC KIT
contains 2 lbs. plexiglass & Lucite sheet in various shapes, 1 oz. bottle of clearset cement, and 5 bottles of colors in Orchid, Red, Yellow, Peach, etc. Also a Plastic Handbook of uses & instructions. This set easily worth $5.50. Our Price **$2.19**

Plexiglass & Nascolite clear plastic shts.
NASCOLITE — Full sheets app. 1/8" x 37½" x 49½", app. 10½ lbs. each $12.50

AAF CASE
Genuine top grade leather. Multi-compartment. Lock and Straps. Ideal for Artists, Students, Salesmen, etc. Used, good condition. . . **7.95**

BOLO KNIFE
10" x 2" Parkerized blade. 5" Gripped Handle. Weight 1½ lbs. . . . Ideal for Hunting, Clearing Brush or Trails. With Case **1.19**

Home Brand PLASTIC LEATHERETTE
Waterproof, Heat Resistant plastic covering. In Yellow — Chinese Red, Green, Grey, Chartreuse, Brown Yacht Blue, 54" Width. ONLY **1.95**

GOOSENECK LAMP
Consists of 24 volt control box with dimmer switch, 18" flexible extension & frosted glass shade. Can be used on 110 volt current.. **2.49**

AIR CORPS HELMET
Fine grade leather .. Chamois lined with chin cup on strap. Intermediate weight .. Ideal for summer wear. NEW ONLY . . **1.59**

RADIO HEADSET
Low Impedence. Ideal for amateur radio, crystal sets, or professional use. Adjustable ear phones. Used and in excellent condition. . . **1.59**
HS-30U — Two Magnetic Type receivers in watertight brass case. Soft rubber inserts in each receiver to fit into wearers' ear. Pliable steel head band. Ideal for communications, divers, workers in noisy compartments, etc. NEW **1.59**

NAVIGATORS LAMP
A handy light for desk, work bench, chart table, engine room, etc. Can be used on 6-12-24-110 V by changing bulb. 3 ft. shaft has 4 joints to adjust position... ONLY **$2.95**

PLASTIC PARALLEL STRAIGHT EDGE
with knobs and rubber pads for non slippage on each section. A must for navigators, mechanics, draftsmen and engineers . . . You've never seen 'em at **97¢ ea.**

COMPASSES
No. 152 - MATCHBOX Jewel & Floating dial. **39c**
No. 153 - JEWELED Watch pocket . NEW!! **1.59**
No. 154 - WRIST STRAP type. **69c**
No. 155 - Navy POCKET CARD TYPE . Plastic case. . **89c**

NAVY *Sealed Beam* LAMP
U.S. Navy Portable Pistol Grip light. Has sealed beam and aiming sight. Ideal for search, spot or Emergency light on auto, boat, farm etc. . . . . .
12 Volt light, 4" lens **2.95**
24 Volt, 5" lens & carry case . . **3.49**
Set of 3 filters, Red, Grn, Amber (specify type lamp) . . . . . . **99¢**

New Navigators Magnetic Compass
Type D-12 — Size 7" dia. by 4½" deep. Rubber lined rotating verge range ring . . . calibrated in 1° from 0-360°. 2 parallel grid wires for alignment with N-S line. **$14.95**

Loose Leaf BINDER
3 metal post. Cylindrical locking heavy duty 3/16" fabricated hinged cover. End identification window. Ideal for price books, salesmen catalogues, photo albums, students publications, Reference books, etc. Will hold 500 sheets, 8" x 11". **59c ea**

MESS TRAY
6 Compartment — Stainless Steel — Rustproof. Wonderful for Outdoor Serving, Barbecue etc. Saves dishwashing. Ideal for use in the home, hospital, "roughing". 311A—Used but in excellent, Serviceable Condition. **79¢**

CLAMP-ON ANYWHERE LAMP
With adjustable ball and socket swivel head, long rubber covered cord and wall plug.
The All Purpose Lamp. Wonderful for Indoor Photography. Floodlights. Baby Spot or Large Spot, Personal Bed Reading. Workbench. Garage, etc. Lamp Alone **99c**
Highly Polished 9" diameter Parabolic Reflector or 5" diameter Spot Reflector at Only **85c ea.**

TROUBLE LIGHT
With heavy duty reflector guard, all-rubber covered socket with built-in switch and female outlet. NEW
With 25 ft. extension cord. . . $2.29
With 50 ft. extension cord. . . $3.09
EXTENSION CORD — 18-2 rubber covered. Complete with male & female plugs. 25 ft. 1.49 50 ft. 2.49

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LARGEST FIRM OF ITS TYPE IN THE WORLD

Order from this Ad. All sales final. All Prices F. O. B. Glendale. Pay by M.O. or Check. P.O.'s Accptd. from D & B. firms. ⅓ deposit with C.O.D's.

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SAVE UP TO $50 OR MORE

EXCLUSIVE GIL-BILT BUILD-IT-YOURSELF FEATURES

- Engineered for home construction by world's leading manufacturer of build-it-yourself power tools.
- No machine work. Build easily with hand tools only.
- No guess work. No blueprint reading. Step-by-step pictorial plans, full size patterns, actual photographs.
- Sturdy wood & plywood construction, engineered for reduced noise and vibration.

GIL-BILT 36 INCH ATTIC FAN

- Molded rubber cushions minimize vibration.
- Soundproofed ball bearings, sealed against dust and dirt.
- Efficient 36 in. Torrington Steel Blade.
- Horizontal mounting makes installation easier.
- Rubber cushioned mounting brackets reduce noise.
- 9000 C.F.M. with 1/3 h.p. motor. Cools entire house.

GIL-BILT KIT #510-A Includes Plans, bearing blocks, 3/4 inch steel shaft, Torrington blade, two V-pulleys, V-belt, rubber cushions, mounting brackets, plus all necessary screws & bolts (less motor & wood for wood parts) **$25.95**

GIL-BILT Plans #510, Full Size Patterns, Installation Instructions 1.00

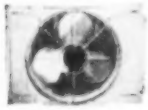
GIL-BILT 24 INCH WINDOW FAN

- Two heavy GILITE oilless bronze bearings
- 24 inch TORRINGTON 40 degree pitch aluminum blade
- Pedestal mount for blade and pulley simplifies construction. Shipped ready to run.
- Mounts out of way on outside of window.
- Belt driven with any 1/8 or 1/4 h.p. motor.
- Rubber cushioned mounting brackets reduce noise, simplify installation.
- 5000 C.F.M. at 620 r.p.m. cools 4 or 5 room house.

GIL-BILT KIT #520-A Includes Plans, TORRINGTON rustproof blade and V-pulley mounted ready to run on cast aluminum pedestal, V-belt, motor pulley, mounting brackets, plus all necessary screws and bolts. (less motor and wood for wood parts) **$19.95**

GIL-BILT Plans #520, Full Size Patterns .50

GIL-BILT 20 INCH ROOM COOLER FAN



- Complete fan shipped ready-to-run. Cut out plywood panel and bolt to fan guard with four bolts.
- Direct drive nationally known REDMOND motor complete with cord and two-speed switch.
- Precision balanced TORRINGTON blade.
- Sturdy wire guard, rubber mounted to minimize vibration.
- 3000 Cu. Ft. of air per Min.
- Build to fit any window 24 inches wide or over

GIL-BILT KIT #530-A. Includes Plans, all screws and bolts. Motor, blade, guard, switch, and cord shipped completely assembled ready to run (less wood panel) **$28.95**

GIL-BILT Plans #530, Full Size Patterns .25

NO DEALERS - One Low Factory Price! Prices include postage within 600 miles. Over 600 miles add 5%. Send cash, check or money order for fan kit, or send for Plans now and order Kit later less cost of Plans. Write for free descriptive folder.

GILLIOM POWER TOOLS

P. O. BOX 1-VC Lambert Field St. Louis 21, Mo.

PEEL PAINT TO BARE WOOD WITH ONE EASY STROKE

NEW ELECTRICAL TOOL removes 1 to 10 or more coats of paint from any wood surface as easy as cutting butter with a hot knife. No scraping, cutting, burning, sanding, or chemicals. The new Lectro Paint Peeler instantly softens paint electrically and peels it off the surface clean to the bare wood with one easy stroke. It's faster than a blow torch—there's no danger of fire—will not scorch or burn delicate wood surfaces. Makes no mess—no smell—it's even fun to use. Removes any paint, enamel quickly and easily. Sturdily constructed to last for years. Sent complete with extra long, quality electrical cord. Simply plug into any A.C. or D.C. outlet—let heat for several minutes and remove paint to the bare wood on exterior or interior painted surfaces, floors, woodwork, cupboards, furniture, antiques, boats, window sills, screens, doors—a hundred other uses. Price $4.95 postpaid—nothing else to buy. Full money back guarantee. For immediate shipment—send check, cash or money order to

LECTRO WELD, INC.

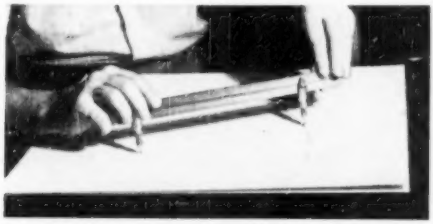
5700 Detroit Ave. Dept. PS-7 Cleveland 2, Ohio

New

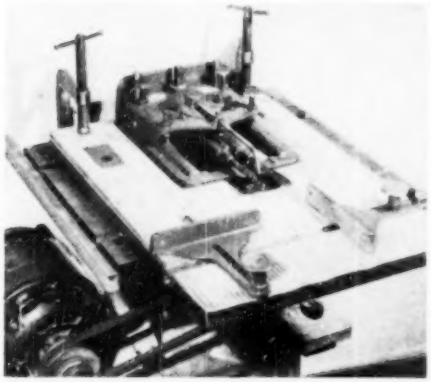
Gauge Measures V Belts. The Belt Meter, made by Goodyear Tire and Rubber Co., Inc., of Akron, Ohio, quickly determines the length of a V belt. The belt is clipped in place against a knurled knob, and is then pulled through for a full circuit. The knurled knob turns a worm gear that moves an indicator, showing the length in inches. The device takes light-duty belts.

Saw Blade Is Rotatable. If you've ever skinned your knuckles using a keyhole saw in a tight spot, you'll appreciate this saw. The blade can be turned through 360° and locked in any of eight positions. If you want to cut right up to a wall, you can have the handle in the normal position while the blade's teeth are facing the wall. The tool is made by the Millers Falls Co., Greenfield, Mass. Price is $2

Tools



Trammel Heads for Craftsmen. When used with a combination square or steel rule, these trammel heads make an accurate compass, height gauge, inside calipers, outside calipers, or scribers. The Engineering Research Associates, of Hazel Park, Mich., manufacture the heads. Each set of heads includes scriber points, pencil tips, and special caliper points. The retail price of a set is about $3



Double Drill Fits Saw Table. These twin horizontal drills for doweling jobs are belt driven by the motor of a bench saw. The saw blade is removed and the unit clamped to the table. The chucks are lined up with a pulley on the saw spindle and the belt tightened by lowering the spindle or raising the table. The drills can be adjusted up or down in relation to the table. The Hadwiger Manufacturing Company, of Pueblo, Colo., prices the multiple-drill unit at $40.

AMAZING NEW 3 SPEED

- BUFFER
- SANDER
- POLISHER

Fits Any 1/4" Drill

Now you can buff, sand, grind and polish at exactly the right speed. Most flexible kit ever offered. New, exclusive, 2 speed right angle drive unit gives just the right speed for every operation—double drill speed for fast, fine sanding, 1/2 drill speed for added power and high lustre polishing and buffing, direct drill speed for run-of-mine work. Light and easy to use. Swivel action between drill chuck and angle drive unit permits use at any angle on any surface. Even an inexperienced operator can get professional results. Buffs, grinds, polishes, sands car bodies, furniture, woodwork, floors, metals. For home and shop use, garages, farms, service stations, machine and cabinet shops, building maintenance and many other uses. Heavy duty steel cut Zerol gears of right angle drive operate in grease-packed, sealed chamber. Will give long, hard, smooth service. Complete kit includes:

Right angle drive 2 speed unit
Flexible molded rubber head
Direct drive adaptor, cup washer, screw
Polishing bonnet, highest grade lambs wool
Heavy-pile carpet compound rubbing pad
Three sanding discs—coarse, medium, fine grits
Full directions

Full money back guarantee. Sent postpaid anywhere in U. S.

DIRECT DRIVE
Polishing and Sanding Kit

ONLY **$1.49** Postpaid

Designed for use with any electric drill. Kit contains: Rubber head with cup washer, screw and adaptor; highest grade genuine lambs wool polishing bonnet; medium grit sanding disc. Ideal for use with chuck and drill bench mountings and for 1/4" electric drills. Operates at drill speed. Full money back guarantee. Sent postpaid anywhere in U. S.

PALM GRIP RATCHET SCREW DRIVER SET

ONLY **$6.50** POST PAID

Handiest thing yet for loosening those hard-to-get wood and metal screws. Heavy duty palm ratchet fits 3/8" standard socket in driver heads. Also fits all 3/8" standard wrench sockets. Heavy duty screw drivers have tool steel blades and tough, non-burning "Tenite" handles. 3 sizes fit every need. Practical, time saving. Designed for auto mechanics, machinists, electricians, carpenters, farmers, home craftsmen, building maintenance men, cabinet and furniture workers. Palm ratchet operates right and left with center lock. Full money back guarantee. Sent postpaid anywhere in U. S.

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LAKE SALES, INC.
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Enclosed find ( ) cash; ( ) check; ( ) money order for which please send me the kit checked below.

( )	Complete, 3 Speed Kit	$7.95
( )	Direct Drive Kit	1.49
( )	Ratchet Screw Driver Kit	6.50

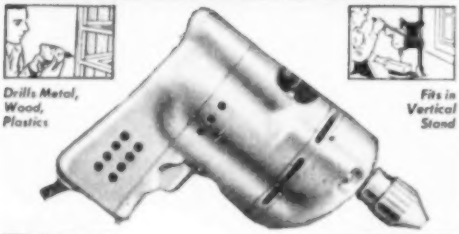
Name: .....

Address: .....

City & State: .....

DEALERS—SEND FOR FULL INFORMATION

Handy Power Drill Big Help in Homes!



HOME-UTILITY ¼" Electric DRILL

$18.95

Saves Hours on Many Jobs!

Wouldn't you like to speed up building and repairing things around your house—finish more projects in your spare time—turn out work you can be proud of? This versatile Home-Utility ¼" Drill is the answer! You'll be amazed at the way it helps you install household hardware and fixtures, polish silverware, wax furniture, sharpen cutlery and tools, sand down furniture, knock off old paint and rust!

Quality built by BLACK & DECKER, world's largest maker of portable electric tools, this powerful Home-Utility Drill operates on A.C. or D.C., with a handy trigger switch. It's compact, lightweight, well-balanced, shaped to fit the hand, easy for the lady of the house to operate, too! Try it at your hardware, electrical or implement dealer's. Let him show you the many attachments which make it a timesaving, work-saving appliance for your home! THE BLACK & DECKER Mfg. Co., Dept. H78, Towson 4, Md.

Products of The BLACK & DECKER Mfg. Co.

ELECTRIC HOME-UTILITY TOOLS

6" Saws | ½" Drills | 5" Sander-Polishers | ¼" Drill Kits | 6" Bench Grinders

METAL REPAIRS ARE EASY WITH KESTER METAL MENDER (GENUINE TIN LEAD SOLDER)

FREE "HOW TO SOLDER BOOKLET"

Send for yours today. "Soldering Simplified" . . . 16 pages crammed with instructive photographs and step-by-step explanations of how to do good soldering.

25¢ IN MOST AREAS

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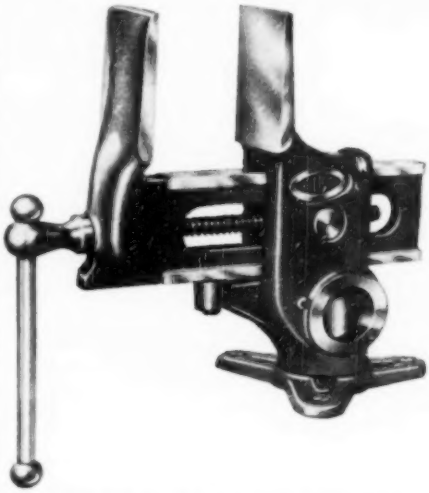
New Tools



Tightening Jaws Locks Base. When the jaws of this woodworking vise are tightened on the work, the vise locks in position on its base, eliminating a separate adjustment. The Versa-Vise can be placed on its steel, post-type base in either the upright position shown, or horizontally on its left or right side. In any of these positions it can be swung 360°. Holding surfaces are 2½" by 3½" and it has a 5" capacity. The Will-Burt Company, Orrville, Ohio, prices the vise at about $9. The tool weighs 16 lb.

Hammer Turns Screws. Tapping this screwdriver turns a screw in or out. With the blade set in the slot of a screw, you turn the handle a little to the right or left. The hammer blows transmit through the driver a twisting motion, turning the screw with greater force than can be exerted conventionally. The tool is made by Allen & Son Manufacturing Co., of Asbury, Mass.

Flexible-Shaft Units. Two portable power units for flexible-shaft tools—the Jiffy Tool and the Speed Jiffy—are being marketed by the Stow Manufacturing Co., Binghamton, N. Y. The Jiffy delivers 1,750 r.p.m. from a ¼-, ⅓-, or ½-hp. motor. For more demanding operations, the other model offers three speed variations—1,000, 1,750, or 3,000 r.p.m. These speeds are obtained by altering the plug-in position of the flexible drive shaft. Both units are mounted on casters and have 5′ shafts.

Drill Becomes Hammer. Any ¼″ electric drill can be converted to a hammer for drilling masonry with this adapter made by the Roto-Power Corp., Brooklyn, N. Y. The tool also can be used for auto-body or fender work. It's priced at $10.75, including the handle. Attachments are available for calking, peening, and riveting.

Speedy Sprayer

Heavy duty all-purpose paint sprayer for Hobbyists, Mechanics, Home Owners who demand superior performance and results!

Here's a real "professional" spray outfit that paints anything from a house to a toy! In addition, Speedy Sprayer handles any material—enamel, varnish, lacquer, calcimine, insecticide, etc. Speedy Sprayer saves time and money, too. Does any job in *minutes* instead of hours . . . makes paint go further. It's the favorite sprayer whose dependability is proven by 20 years of usage. At hardware, paint, lumber or auto supply dealers.

W. R. BROWN CORPORATION
CHICAGO 39, ILL.
Specialists in Portable Sprayers for Over 20 Years!

SPEEDY SPRAYER 890

Delivers 2 cu. ft. per minute, clean, oil-free air at 30-40 lbs. pressure. Operated by any ¼ h.p. motor. Never needs oiling. Complete outfit—gun, valves, nozzles, air hose, less motor.

now only $26.50

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W. R. Brown Corporation
5718 Armitage Ave., Chicago 39, Ill.
Please send me free Booklet "How to Spray. Also Speedy Sprayer literature.

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Address _____
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P.S. Last minute news & notes...

AUTO NEWS: Chrome is being tried in places where it doesn't show. Tests indicate that the life of auto piston rings can be prolonged and cylinder wear reduced by using hard chrome plating on the top ring in each cylinder. . . . Packard is using walnut shells now in making Ultramatic drives. They're ground like coffee and used to blast burrs off of the machined surface of castings. . . . With a new compressor kit made in Britain, you can use your car's engine to blow up a tire. It can be done without stopping the car, moreover, by clipping an air-tight universal joint to the wheel hub.

FOR SEASICKNESS and other types of motion sickness, dramamine is the best bet, New York University doctors report after a study of the effectiveness of a number of the commonly used drugs. It seems to decrease the sensitivity of the body's balance mechanism to the motion of ships, swings, cars, and airplanes.

SURFACTANT is a new word worth knowing. It means a 'surface-active agent.' Surfactants are being used as wetting agents, to disperse grease or solid particles, and to keep fine powders suspended in liquids and lotions. They may make the familiar label, 'Shake Well Before Using,' obsolete some of these days.

RUSSIAN TELEVISION images are being broadcast with a definition of 625 lines, according to Soviet newspapers. Standard is 525 lines in U.S., 405 in Britain, and 819 in France. But the screens of the latest model of Russian receiving sets are only about the size of an American 7-inch screen. . . . U.S. Bureau of Standards, meanwhile, reports it has picked up radio signals sent clear around the world. They were received about .14 of a second after they left the transmitter. On a stormy day they were delayed less than on a normal day.

YOUR DOG can be better protected against rabies with a new vaccine produced from virus grown in chick embryos. Lederle Laboratories experts claim its development will prove to be the greatest step taken towards elimination of rabies as a fatal disease since Pasteur first immunized dogs in 1885.

ATOMS, once supposed to be indivisible, have now been found to contain at least 12 and maybe 13 different kinds of particles. But some don't live long. M.I.T. physicists, for example, have found that the average heavy meson disintegrates in 60 millionths of a second.

NEW PRODUCTS: A plastic, non-metallic sheathed cable made by Plastic Wire & Cable Co., Jewett City, Conn., promises to make home wiring easier. . . . Nu-Way Signal Co., Chicago, is making a door mat that will ring a bell when stepped on. . . . Silicones have been put into a new waterproofing solution by Stop-all, Inc., Kalamazoo, Mich., to help home owners keep basements dry.

GRASS GROWS SLOWER, without being harmed, if sprayed with the correct amount of a weed killer called maleic hydrazide. U.S. Rubber Co.'s experimenters are working with it. They've found that it will also inhibit the growth of shrubbery--and kill off crab grass. But it is not on the market yet, and they insist you may have to wait quite a while before using it in place of your lawn mower and hedge shears.

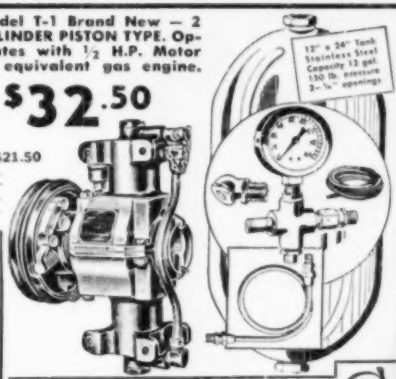
THERMOMETER made at Yale detects changes in temperature as small as a ten-millionth of a degree . . . Goodyear Tire experts have developed a waterproof fabric through which body vapor (they mean sweat) can escape . . . McKee Glass Co., Jeanette, Pa., offers bird houses made of thick, opaque glass in red, green, yellow, or brown.

The Editors

"Wellworth" Sensational Offer! Reg. $60.50
WESTINGHOUSE AIR COMPRESSOR

Model T-1 Brand New — 2 CYLINDER PISTON TYPE. Operates with 1/2 H.P. Motor or equivalent gas engine.

$32.50

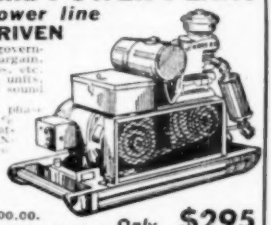


Compressor, pressure tank, air gauge, air chuck, 20-ft. hose, pop valve, copper tubing with 4 brass flared fittings for connecting compressor to tank, 4-way cross end 3 nipples. COMPLETE OUTFIT, wt. 52 lbs.

Equipment less Compressor. $12.50. Compressor separately, $21.50

Compressor has 2" bore, 1½" stroke, ball bearing. 3.27 CFM at 600 R.P.M. Capacity up to 6.54 CFM. Size 9"x11"x6¾". Wt. 26 lbs. Ideal for spraying paints, insecticides, etc., inflating tires, operating air tools, and other uses. All new equipment. U.S. government surplus. Replacement parts available. Amazing buy. Don't miss it.

ELECTRIC LIGHT and POWER PLANT
Same as high power line
GASOLINE DRIVEN

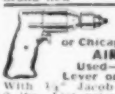


Advantageous purchase from U. S. government enables us to offer this great bargain. Ideal for farms, homes, garages, shops, etc. Will operate oil burner, deep freeze units, compressors, saw, pumps, radio and sound systems and general lighting.
SPECIFICATIONS: 115 Volts, single phase 2500 watt, A.C., 60 cycle with 25% reserve power. ENGINE: Briggs & Stratton, Air Cooled, 6½ H.P. LELAND GENERATOR. "V" Belt drive with guard and Duplex Receptacle plug-in. NET WT. 310 lbs. Shipping Wt. 440 lbs. Brand New! Complete with spare parts, tools, instructions. **Fully Guaranteed.**
MODEL PE 75. Mfrs. List Price $700.00.
OUR SPECIAL BARGAIN PRICE ..... **Only $295**

"WELLWORTH" V-BELT CLUTCH

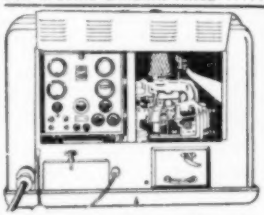
Takes starting load off engines or motors. When speed is reached, a flip of handle shifts clutch from idling to driving position. Handles "A" belts, 2.35" pitch diameter, ⅝" bore. Ideal for use with lawn mowers, garden tractors, home workshop motors, etc. 3½" long. Safety to mount, sealed bronze bearings, tool action. Ship wt. 3 lbs. **$7.50**

Used — Like New!
Chicago Pneumatic Riveter & Chipping Hammer
CP4X Pistol grip handle. Takes up to 3/16" rivet. Weight 6 lbs. List price $75.00.
Ideal for work on fenders and auto bodies.
SPECIAL PRICE **$8.95**
Same as above, brand new **$22.50**



Ingersoll Rand or Chicago Pneumatic AIR DRILL
Used—like new. Lever or Pistol type
With ¼" Jacob Chuck. Wt. 2 lbs. List price $55.00. Only **$14.95**

LIGHT PLANT
REMOTE CONTROL



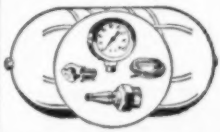
All Brand New Equipment

A fortunate purchase of U. S. Gov. surplus permits us to offer you this opportunity of a lifetime.
GENERATOR: 5,000 watts, 52 amps, 110-120 volts, 60 cycles, 1 phase A.C., rating 25% overload, K.V.A. 6.24. **ENGINE:** 4 cyl. Hercules, 14 h.p. at 1800 r.p.m. Complete panel board, 100 ft. remote control cable, 100 ft. 20 rubber-covered heavy duty cable. Spare parts and tools furnished with unit.

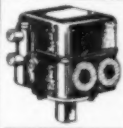
Shipping wt. 1200 lbs. $1500.00 value $495.00

SEND FOR OUR 68 PAGE BOOK. A handy buyer's guide for home and factory workshop. Bargains in motors, air compressors, electric tools, and many more items. Send 10c for postage and handling.

AIR TANK and ACCESSORIES



Air receiver, stainless steel, 12½"x24", 200 lb. test. Ideal for carrying on trucks, autos and wherever compressed air is needed. Equipped with 300 lb. air gauge, tire chuck, 3 ft. high-test air hose, air inflation valve with cone retaining pressure in tank, and fittings. Two openings. **$7.95**
Complete unit. Shipping wt. 20 lbs. Same unit but with 6" x 24" tank **$6.95**



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For Air or Water

20 to 40 lbs.	$5.50
75 to 100 lbs.	7.50
125 to 150 lbs. with unloader	10.25
¼" check valve	2.75
¼" regulator and gauge	5.75

Prices f.o.b. Chicago. Immediate delivery. All items sold on money back guarantee. Send check or money order today.

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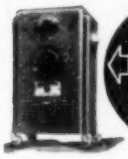

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"Big Pay" jobs await you... Work flows in soon as you are properly equipped to do arc welding. Demand grows fast because you save customers money, yet make a nice profit yourself on every job. Depression-proof—offers more security.

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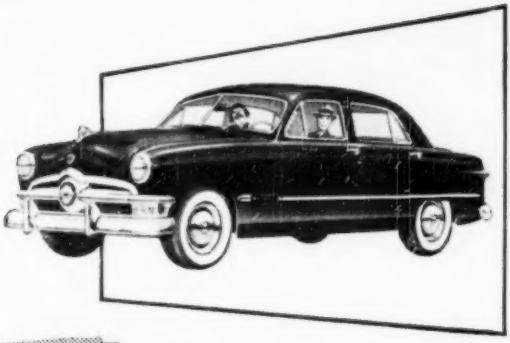


the '50 FORD

for Beauty and Brawn

YES, Ford is such an admired beauty that once again, for the second straight year, it has been chosen "Fashion Car of the Year" by the Fashion Academy of New York!

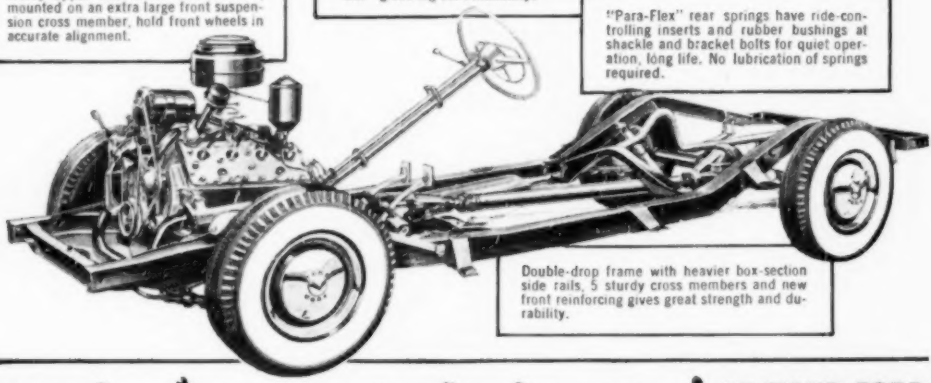
But here's a case where beauty is much more than skin-deep. Here's a brawny traveller that's built to take it—with your choice of two great economy engines . . . 100-h.p. V-8 or 95-h.p. Six. What's more . . .

Ford is an all-around economy car—low in first cost . . . low in operating cost . . . low in maintenance cost . . . high in resale value.

Completely integrated chassis design—balanced spring rates . . . correct braking effort distribution . . . low center of gravity . . . easy, positive steering control—gives big car roadability.

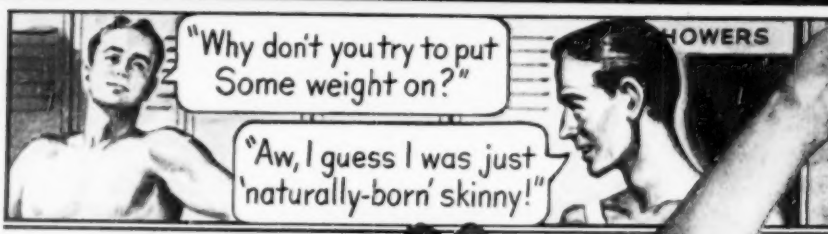
Heavy upper and lower control arms, mounted on an extra large front suspension cross member, hold front wheels in accurate alignment.

"Para-Flex" rear springs have ride-controlling inserts and rubber bushings at shackle and bracket bolts for quiet operation, long life. No lubrication of springs required.



Double-drop frame with heavier box-section side rails, 5 sturdy cross members and new front reinforcing gives great strength and durability.

NOW... "Test Drive" a '50 Ford AT YOUR FORD DEALER'S



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NOBODY IS JUST "Naturally" SKINNY!

Give Me 15 Minutes A Day And I'll Prove YOU CAN BE A NEW MAN

WOULD you believe it? *I* was once a skinny 97-pound weakling. People used to laugh at my spindly build. I was ashamed to strip for sports or for a swim. Girls snickered at me behind my back. Folks said I was just "naturally-born skinny!"

Then I discovered my marvelous new muscle-building system—"*Dynamic Tension.*" And it turned me into such a *complete* specimen of MANHOOD that today I hold the title, "THE WORLD'S MOST PERFECTLY DEVELOPED MAN."

WHAT'S MY SECRET

When you look in the mirror and see a healthy, husky, strapping fellow smiling back at you—then you'll be astonished at how fast "*Dynamic Tension*" GETS RESULTS!

ARE YOU
Skinny and run down?
Always tired?
Nervous?
Lacking in Confidence?
Constipated?
Suffering from bad breath?
WHAT TO DO ABOUT IT is told in my free book!

"*Dynamic Tension*" *is the* easy, NATURAL method that you can practice in the privacy of your own room—JUST 15 MINUTES EACH DAY—while your scrawny chest and shoulder muscles begin to swell . . . those spindly arms and legs of yours bulge . . . and your whole body starts to feel full of zip, ambition, self confidence, and new energy!

I can broaden your shoulders, strengthen your back, develop your whole muscular system *inside* and *outside*! I can add inches to your chest, give you a viselike grip, shoot new strength into your old backbone. I can help you cram your body so full of pep, vigor and red-blooded vitality that you won't feel there's even "standing room" left for weakness and that lazy feeling! Before I get through with you I'll have your whole frame "measured" to a nice new beautiful suit of muscle!

"Dynamic Tension" Builds You NATURALLY

Thousands of other fellows are becoming marvelous physical specimens—my way. I give you no gadgets or contraptions to fool with. You simply utilize the dormant muscle-power in your own body. In a very short time, you'll watch it grow and multiply into real, solid, rippling, *live muscle.*

READ WHAT "DYNAMIC TENSION" HAS DONE FOR OTHERS

Feels Like A New Man—"My chest has gained over 5 inches, arms more than 2 inches. My nervous troubles have vanished and constipation is a thing of the past. I have gained ten pounds and feel like a new man."—G.T.F., Ohio.

Feels Great To Be Strong—"In four weeks I have increased 3½ inches on my chest and half an inch on my neck, 2-inches on arm, 2-inches on forearm, 1-inch on wrist. It feels great to be strong."—R.G., R. I.

Has Perfect Build—"I'm now in the pink of condition. As I was getting into my gym suit the other day, I heard a couple of men say, 'Look at that fellow. He has a perfect build.' They said my muscles didn't bulge out on me but they were well placed."—E.M., Conn.

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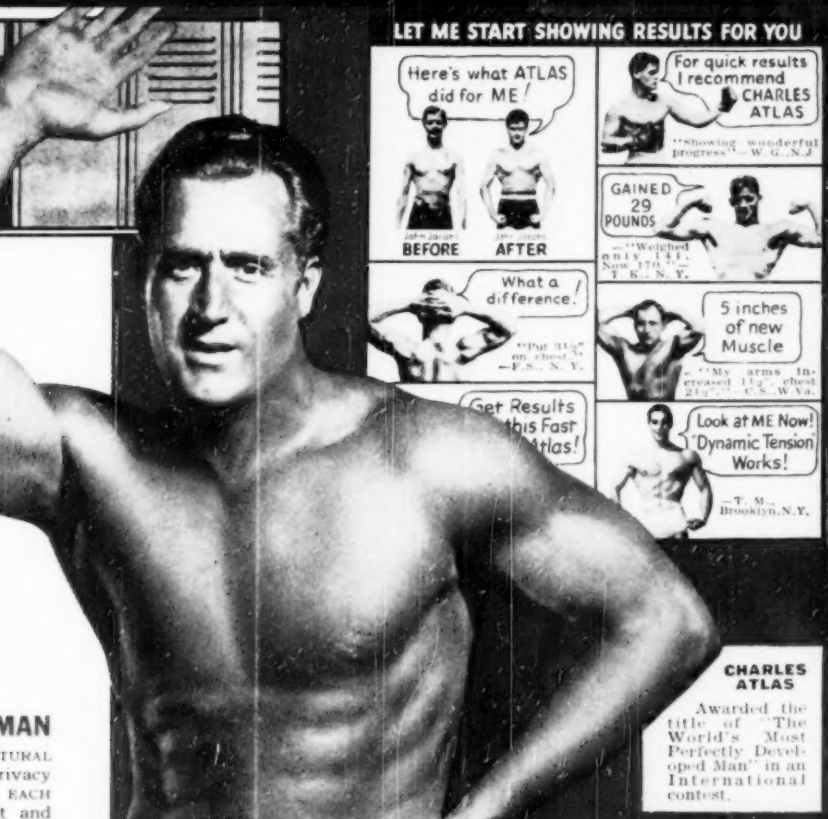

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